THE JOURNAL OF THE
DEFENSE ACQUISITION
UNIVERSITY

# ACQUISITION Review QUARTERLY



VOL. 6 NO. 3




The ***Acquisition Review Quarterly*** is published quarterly for the Defense Acquisition University by the Defense Systems Management College Press, 9820 Belvoir Road, Suite 3, Fort Belvoir, VA 22060-5565. Periodicals Postage Paid at Fort Belvoir, VA and at additional mailing offices. Postmaster send changes of address to: Editor, ***Acquisition Review Quarterly***, Defense Systems Management College Press, 9820 Belvoir Road, Suite 3, Fort Belvoir, VA 22060-5565. For free copies, submit written requests to the above address. Articles represent the views of the authors and do not necessarily reflect the opinion of the Defense Acquisition University or the Department of Defense. ISSN 1087-3112.

The ***ARQ*** is available electronically on the DSMC Home Page at **http://www.dsmc.dsm.mil**

# REPORT DOCUMENTATION PAGE

*Form Approved*
*OMB No. 0704-0188*



| 1. AGENCY USE ONLY *(Leave blank)* | 2. REPORT DATE | 3. REPORT TYPE AND DATES COVERED |
|---|---|---|
| | Summer 1999 | |

**4. TITLE AND SUBTITLE**

Acquisition Review Quarterly (ARQ)
Vol. 6, No. 3

**5. FUNDING NUMBERS**

**6. AUTHOR(S)**

Numerous Authos

**7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES)**

Defense Systems Management College
Attn DSMC Press
9820 Belvoir Road Ste 3
Ft. Belvoir VA 22060-5565

**8. PERFORMING ORGANIZATION REPORT NUMBER**

**9. SPONSORING / MONITORING AGENCY NAME(S) AND ADDRESS(ES)**

Defense Acquisition University
2001 N Beauregard Street
Alexandria VA 22311

**10. SPONSORING / MONITORING AGENCY REPORT NUMBER**

**11. SUPPLEMENTARY NOTES**

**12a. DISTRIBUTION / AVAILABILITY STATEMENT**

Distribution Unlimited

**12b. DISTRIBUTION CODE**

**13. ABSTRACT** *(Maximum 200 words)*

The primary goal of the Acquisition Review Quarterly (ARQ) is to provide practicing acquisition professionals with relevant management tools and information based on recent advances in policy, management theory, and research. ARQ addresses the needs of professionals across the full spectrum of defense acquisition, and it intended to serve as a mechanism for fostering and disseminating scholarly research on acquisition issues, for exchanging opinions, for communicating policy decisions, and for maintaining a high level awareness regarding acquisition management philosophies.

**14. SUBJECT TERMS**
Acquisition Contractss, Aviation COTS, Research & Development, International Cooperative, Cost Management.

**15. NUMBER OF PAGES**
124

**16. PRICE CODE**

| 17. SECURITY CLASSIFICATION OF REPORT | 18. SECURITY CLASSIFICATION OF THIS PAGE | 19. SECURITY CLASSIFICATION OF ABSTRACT | 20. LIMITATION OF ABSTRACT |
|---|---|---|---|
| Unclassified | Unclassified | Unclassified | Unlimited |

# ACQUISITION Review QUARTERLY

**Summer 1999**
**Vol. 6, No. 3**


## TABLE OF CONTENTS

## OPINION

# INTERNATIONAL COOPERATIVE RESEARCH AND DEVELOPMENT PROGRAMS

**Neal Pollock**

From a review of the literature and more than 30 interviews from those who work on International Cooperative Research and Development Programs comes a wealth of theoretical and practical advice on how to help these often logistically, politically, and economically complex projects succeed.

Before undertaking an international cooperative research and development program (ICRAD), where does a program manager go to find guidance on what to do and what to avoid doing? There is a dearth of published data in this area, although some unpublished documents created for internal use do exist.

The study described here set out to answer that question. It consisted of research of the available literature as well as interviews with 32 people from the Defense Department, industry, and foreign military departments who work on ICRADs (defined as programs developed cooperatively by two or more nations in which the design or technical effort and the costs are shared by those nations). The aim was to obtain a cross-section of perspectives and cover a full range of factors relevant to ICRADs. With the addition of the author, the interviewees had more than 400 years of international experience out of a total of more than 800 years of overall work and acquisition experience; this is an average of more than 12 years international and 24 years overall experience per person. Most of this experience was with North Atlantic Treaty Organization (NATO) programs.

While the data is anecdotal, a large enough sampling was sought to provide a comprehensive overview. The research objective was to elicit frank comments and suggestions from experienced people that can be used by others to establish and implement current and future ICRADs. All interviewees were guaranteed anonymity (and unattributed quotes in this article are from interviewees).

## WHY COOPERATE?

The Report of the Quadrennial Defense Review (Cohen, 1997) states that "we as a nation must often act in concert with others to create our preferred international conditions and secure our basic national goals. ...Therefore, it is imperative that the United States strives to build close, cooperative relations with the world's most influential countries." Furthermore, "To maintain this superiority, we must achieve a new level of proficiency in our ability to conduct joint and combined operations...The RBA [Revolution in Business Affairs] includes...increasing cooperative development programs with allies." For instance, the Navy reports a trend toward increased cooperation during the past decade (Figure 1) (Navy International Programs Office [NIPO], 1997). To the trend toward coalition warfare, Abbott (1997) adds the advantages of standardization, interoperability, common logistics, and the reduced defense budget as reasons for a greater mandate for cooperation.

The decreasing budget has resulted in a steady decline in government research and development (R&D) expenditures relative to industry (NIPO, 1997). The State Department points out that "the perception that we are withdrawing physically and psychologically undercuts Germany's essential interest in our

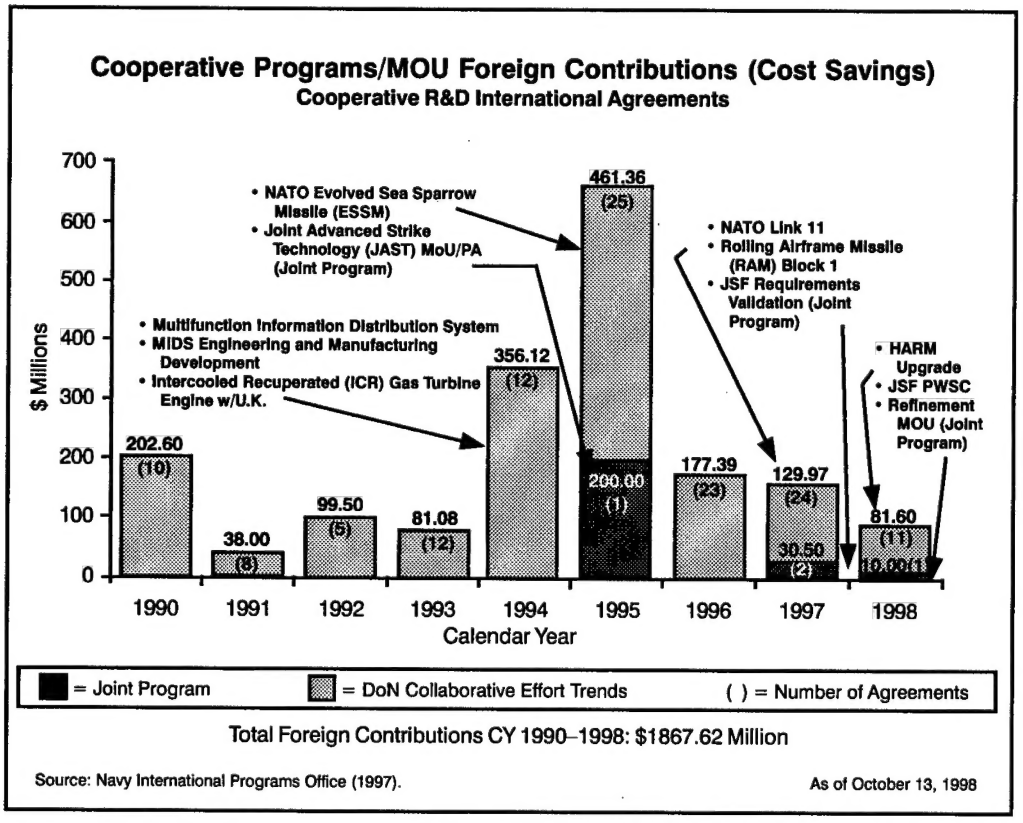
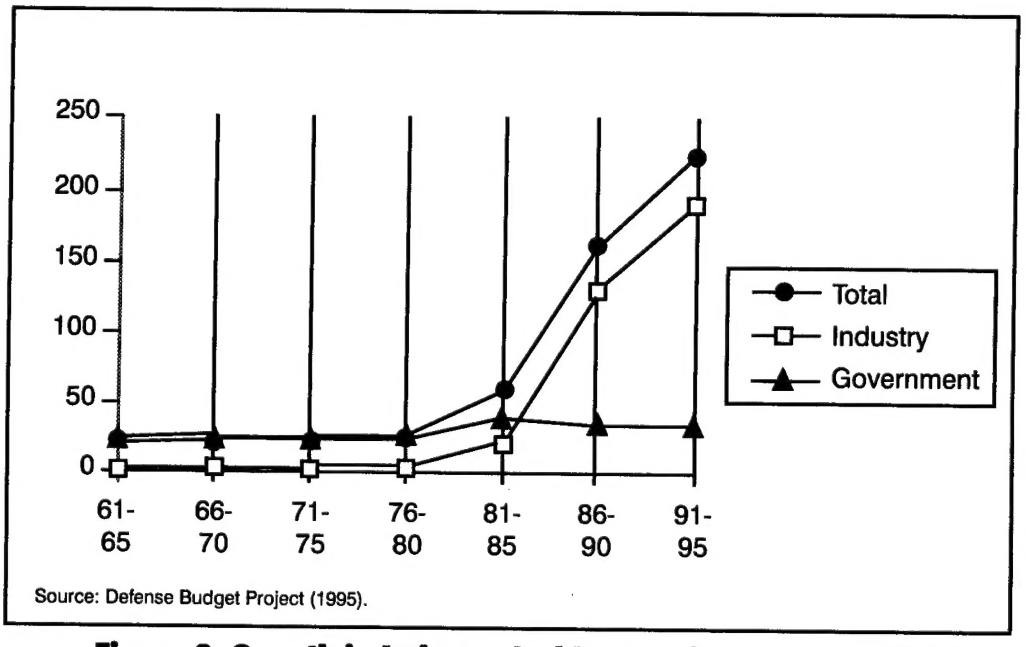



**Figure 1. Department of the Navy Collaborative Effort Trends**

security relationship, which allows it to pursue a pan-European agenda without appearing to threaten the rest of Europe. It also undercuts our interest in moving the bilateral relationship in directions that will positively affect outcomes in and beyond Europe" (Jones, 1997). Technologically, information warfare, operations other than war (OOTW), and the global simulation network present unique challenges best met globally, in concert with our friends and allies. Politically, ICRADs promote allied industrial bases, help allies defend themselves, and strengthen coalitions to forestall the establishment of "Fortress Europe" and "Fortress America." As President Bill Clinton (1997) observed, "the United States squandered Allied victory in World War I when it embraced isolationism." In today's global economy, commercial international programs are important to America's well-being, especially as the U.S. defense industry consolidates through mergers and acquisitions (Dalton, 1997) (Figure 2 [Abbott, 1997]). Thus, Department of Defense Directive (DoDD) 5000, *Joint Vision 2010* (Shalikashvili, 1997), and the *National Military Strategy of the U.S.A.* (Shalikashvili, 1997) all lend considerable support to ICRADs. In the words of one foreign interviewee, "America is a European power."

## Why Not?

Cooperation has had "more starts than finishes" (Abbott, 1997), leading to pressure for pan-European versus transatlantic cooperation (D'Agostino, 1996). While many reasons for failure have been cited (e.g., program selection, poor timing, lack of training), many Americans perceive that the U.S. system is highly problematic




Source: Defense Budget Project (1995).

**Figure 2. Growth in Industry-Led International Cooperation**

(Kwatnoski, 1995) and that ICRADs add risk to program managers without compensatory advantages (Deputy Under Secretary of Defense for International and Commercial Programs, or DUSD[I&CP], 1997). Of course, these reasons do not address the nonrational or irrational effects of "not invented here," xenophobia, and cultural differences.

## History

The DoD Authorization Act of 1986 initiated the NATO Cooperative R&D Program to promote more equitable sharing of NATO conventional research and development costs via cooperative projects. Congress believed that the Warsaw Pact was more cost effective than NATO due to lack of NATO cooperation (General Accounting Office, 1990). Congress appropriated "Nunn funds." Proposed by Senator Sam Nunn, "Nunn" funds are annually budgeted by Congress as a special fund (in four sub-accounts for the three services and the Office of the Secretary of Defense [OSD]) to be used as seed money to begin ICRADS. These funds can only be spent in the United States. Congress later added five non-NATO nations (Australia, Egypt, Israel, Japan, and South Korea, later followed by two more, Argentina and Jordan). Similarly, legislative relief (but not funds) was provided for cooperative production projects. Nevertheless, no cooperative program has proceeded through R&D, coproduction, and operations and support thus far. DoDD 5000.1 (1996), the acquisition "Bible," lists cooperation second (after purely commercial products and above joint programs) in its ordered hierarchy of materiel alternatives. In addition, DoD sponsors numerous other programs (such as a data exchange annex, or DEA) that could, in theory, develop into ICRADs.

**"Because of ICRADs' poor track record, the Services didn't want to cooperate, creating a self-fulfilling prophecy."**

In the past, however, programs chosen as ICRADs tended to be noncritical, low priority, poorly funded ones. Nunn funds would be used to cover startup costs for programs that did not make Service funding lists, and they could easily die when the Nunn funds ran out. International commitments that did not (in the Service's opinion) critically support war fighting requirements lost out in competitive Service program objectives memorandums (POMs). In other words, tactical support to marginal or fringe programs was insufficient to ensure their continuity when unsupported at the operational level. Even "strategic" generic support to ICRADs by the DUSD(I&CP) could only save a few select projects (the fate of one of these, the mobile extended air defense system, or MEADS, is still in question). In addition, entrenched bureaucracies, with their own agendas, made no concessions to ICRADs versus domestic projects despite ICRADs' inherent, added administrative burdens (e.g., memorandum of understanding [MOU] development and negotiation). To top it off, the bureaucracy "moves with the speed of a dead snail."

While larger programs are required to submit a Cooperative Opportunities Document, this generally has consisted of "the 47 reasons why they didn't become cooperative." Because of ICRADs'

poor track record, the Services didn't want to cooperate, creating a self-fulfilling prophecy. Since cooperative programs are more difficult and complex, they have a lower probability of success. Certainly they have more players with the resulting exponential increase in communications links. According to the Law of Requisite Variety, the problem and (solution) environments need to have the same level of complexity. Additional resources are required to handle increased ambiguity. According to Jacobs and Jacques (1986), an integrative, collegial, nonlinear, nonrational, open systems approach is required under conditions of increasing uncertainty. Such an approach is inherently nonbureaucratic.

## Getting Started

As with any analysis of alternatives, both incentives and disincentives must be considered. The best candidate ICRADs propose to satisfy Service operational requirements (commander-in-chief needs) as well as those of NATO (used here to include the additional five nations—the seven Nunn nations plus Sweden—with whom Congress has specifically authorized ICRADs). Of course, multiservice requirements can add a broader support base. Technologies in which our allies can make more significant contributions through extant knowledge or mutual use (such as mine warfare, interoperability, or increased competition base) are highly advantageous prospects. Evolving technological needs such as coalition OOTW are also prime candidates.

One needs to "service the circuit" for possibilities and opportunities for cooperation. Unfortunately, the Services are not organized alike. For instance, one Service splits up authority by type of equipment, making it difficult to coordinate with other Services or nations that use centralized systems. The Services were not designed with international cooperation in mind. Of course, it's a waste of time to start a program with no compelling U.S. need (e.g., the success of the multifunctional

Official DoD photo.

**The F/A–18**

information distribution system [MIDS] was due to the F/A–18's need for it). It should be in the POM, or potentially so, in its own right.

ICRADs save scarce U.S. R&D funds, but they also take longer. In essence, the United States trades time for allied funds. The program in question must be able to withstand the added time required. Thus, the present International Cooperative Opportunities Group (ICOG) effort is aimed at very early stages of development; "gleam in the eye" timing. Unfortunately, in an era of declining budgets, this limits opportunities for larger (ACAT [acquisition category] I or II) efforts. "Adapting cooperation to an existing program is doing it backwards," and it results in disasters. Also, the timing of the project must be matched for the nations involved; required fielding dates must be comparable. Joint programs have similar challenges.

**"The difficulties of introducing major change into a large bureaucracy are legion...."**

Time can be saved and many problems ameliorated if a program is built upon prior efforts. A data exchange annex (DEA), an annex on a particular technical area to a master data exchange agreement between the United States and another nation, which allows for the international exchange of scientific and technical information among scientists and engineers, can serve as a springboard to a successful ICRAD. So can Engineer and Scientist Exchange Program experiences (Trimarran is one—a Navy ship development program) (Kwatnoski, 1995). Indeed, it may be valuable to continue a DEA during an ICRAD to facilitate communications and data sharing (easier to initiate under a DEA than under an MOU). While some say that "the best ones bubble up in a lab, while the weakest ones are top-down directed," others stress the need for buy-in from both the requirements and acquisition communities.

## Relations With Higher Authorities

The difficulties of introducing major change into a large bureaucracy are legion: You can't turn an aircraft carrier in a 10-foot circle. A change agent must address the psychological turn radius; people operate under psychological laws rather than the laws of physics (Pritchett, 1993). Thus, a purely top-down approach rarely works—when it seems to work, it generally doesn't last long (only till the driving force leaves). There is a long list of blue ribbon panel reports and DoD initiatives one can review at leisure; the successful change they have accomplished, however, makes for a quick read indeed.

Some evolutions have better chances for success. The recent introduction of acquisition reform may be one, particularly because of its emphasis on customers and stakeholders and its practical method of integrated product teams (IPTs). Thus, acquisition reform can be instrumental in resolving differences in requirements and perspectives, such as harmonizing joint requirements for the advanced concept technology demonstration project to "translate" messages between the U.S. Army and U.S. Marine Corps variable message format, and the U.S. Air Force and U.S. Navy Link 16 data transmission system. The four Services met and devised (with some difficulty) an initial set of

messages to be so "translated." Similar efforts are under way for ICRADs (e.g., ICOGs). Of course, multinational programs with European partners have historically used steering committees to reach mutually acceptable agreements addressing problems and opportunities. The lesson to be learned is that stakeholders tend to buy in when they were part of the decision and party to the process.

Correspondingly, total quality management/leadership (TQM/TQL) has failed, at least in some commands, because not all levels of management bought into it. In a particular systems command, for instance, the commanding officer pushed it, and many workers bought in and joined numerous process action teams. While some improvements were implemented, TQL never entered the culture because mid-level management never accepted it. Leaving primary stakeholders out of the process inhibits its effectiveness and longevity. The ultimate success of ICOGs and ICRADs depends on across-the-board acceptance from all major players at various levels within DoD. The Quadrennial Defense Review's creation of an international cooperative task force or the creation of the Armaments Cooperation Steering Committee will not, in and of itself, accomplish any more than the cooperative opportunities documents.

The fact that Jacques Gansler, who chaired the Defense Science Board study (1996), has become Under Secretary of Defense (Acquisition and Technology) (USD[A&T]) appears to be a good sign for both acquisition reform and cooperation. As Pritchett (1993) emphasizes, top-level support is essential for culture change. This includes top-level requirements people as well. The Joint Chiefs of Staff (JCS), the commanders in chief, and Service requirements personnel establish the out-year needs to be cooperatively met. At present, JCS support seems lukewarm and the commanders in chief have evidently not been players at all.

Stating a need for cooperative programs and coalition warfare in the *National Military Strategy of the U.S.A.* (Shalikashvili, 1997) and *Joint Vision 2010* (Shalikashvili, 1997) is not comparable to active support by the Atlantic Commander or Supreme (NATO) Commander, Atlantic. The Atlantic Commander and European Command (a U.S. commander in chief), with vested interests in NATO coalition warfare, are prime candidates for support. Larger programs need early, high-level endorsement. MIDS, for instance, benefited substantially from strong USD(A&T) support. In addition, as the U.S. national armaments director, he is positioned to influence high-level Europeans to open doors, leading to fruitful lower level contacts between nations.

**"Ensuring that the warfighter receives maintainable and supportable systems is the goal of LT&E."**

But, OSD/JCS support has not guaranteed success. MEADS, for instance, has barely survived despite Congressional and OSD support. A truly successful program needs a solid Service requirement to be an unqualified success. MIDS has succeeded (despite the U.S. Air Force pull-out early in the program) only because of the F/A–18's need for it. With the eventual phaseout of the F–14, the F/A–18 will be a carrier's *only* fighter and attack aircraft. Nothing beats a real need. Thus, ICOGs emphasize primary versus

marginal requirements for new ICRADs. Groups such as the Navy's Requirements and Resources Review Board (advising the Chief of Naval Operations on POMs) should be tied into the ICRAD development process.

Of course, a joint, cooperative program, while more complex, provides additional, potential advocates for the program and identifies parallel requirements. Should some end, the program may still survive (as did MIDS). Such programs may also receive additional OSD support and funding. Since the DoD infrastructure "tends to ignore MOUs," it's important to "get the Three Stars involved in the process before the MOU is signed." Since Service priorities are often the opposite of the DoDD 5000 priority list, cooperative benefits to the Services must be highlighted to avoid future Service funding cuts. Milestone Decision Authority (MDA) support is essential for any program, but since MOUs can be political footballs (with politics overriding business sense), Service support (both requirements and acquisition) is quintessential for ICRADs. In addition, MDA-granted waivers should be achieved prior to signing an MOU.

True success, however, may depend on getting policy, requirements, and acquisition to gel, simultaneously incentivized for success. Then partnerships of "yes-sayers" can check the usual herds of naysayers. Figure 3 depicts a force-field analysis in which to prioritize efforts to enlist stakeholder support, considering their initial position regarding ICRADs and their

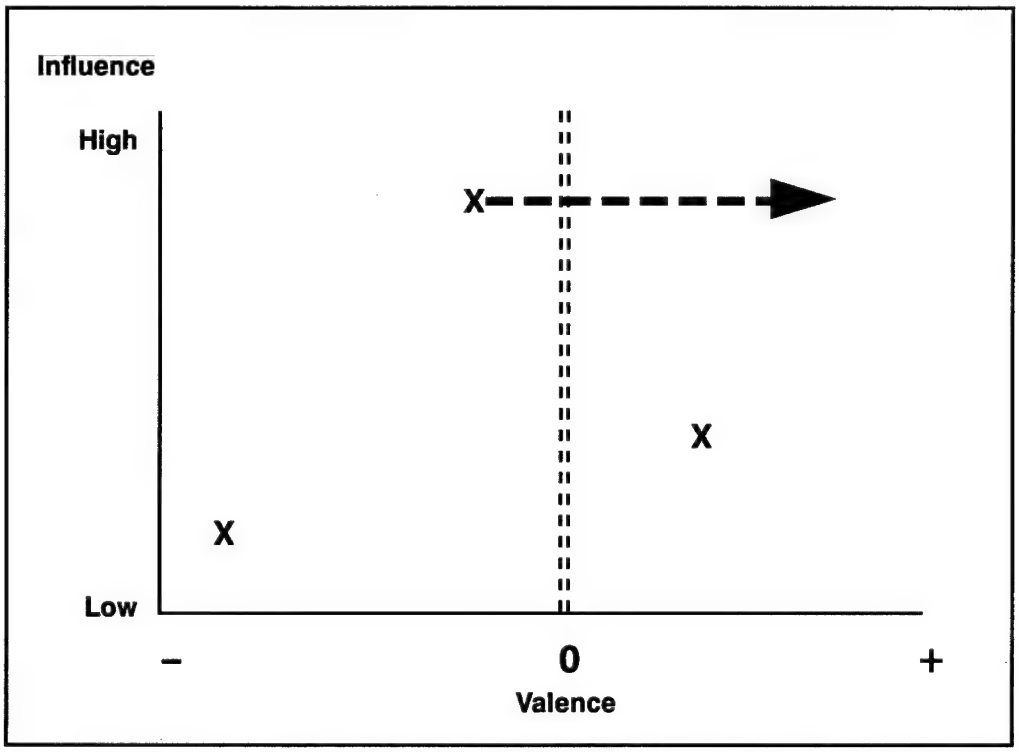



**Figure 3. Stakeholder Force-Field Analysis**

influence level. The "X" with the arrow is a stakeholder with high influence and slightly negative valence—slightly opposed to a cooperative proposal—presenting the best cost-benefit ratio for one's efforts to gain support for a cooperative approach.

With trust always a major issue, personal contacts are important and effective, since "familiarity breeds credibility." International Overarching IPTs (OIPTs) must be extended to ICRADs and could include appropriate State and Commerce department members. It's better than "going to war with the State Department."

## Definition of Requirements

A cooperative requirements phase is absolutely necessary before beginning development or signing an MOU. In addition, a solid Service(s) mission need should be well established before negotiating cooperative requirements. A signed operational requirements document (ORD) (with Joint Requirements and Oversight Council and Joint Requirements Board support) and threat assessment are highly recommended as well. A NATO staff requirement or Military Operational Requirement can also be quite valuable. Optimally, the program can be linked to commander-in-chief regional strategies, *Joint Vision 2010* (Shalikashvili, 1997), the *National Military Strategy of the U.S.A.* (Shalikashvili, 1997), the DoD international strategic plan, and especially, Systems Command and program executive office business plans and budgets. More specifically, the planning horizon must be appropriate, allowing enough time for MOU negotiations as well as international program development.

Prospective participants must have a common need, not only of technical specifications, but also of need dates, and acceptable system maturity and risk. While interfaces and protocols are priority issues, platform integration should be excluded from common efforts. The goal is a set of mutually acceptable, fully harmonized and rationalized, functional performance specifications versus a target equipment design.

As much acquisition reform as possible should be incorporated (e.g., commercial specifications or NATO standardization agreements versus mil-specs or standards). While commercialization is new to some countries, most are familiar with ISO 9000/1, a usable base-line for the introduction of commercial parts and specifications.

Successful harmonization depends on securing a proactive advocate for cooperation and sensitivity to foreign partners' perspectives and concerns.

- "Don't try to force things down NATO's throat." It is wise to use written definitions, consistent terminology, and sensitivity analyses to refine requirements and avoid gold plating.

- "Clarity, stability, and mutual understanding of project requirements were considered to be of paramount importance" (Kwatnoski, 1995). Explain and persuade; "I need it" doesn't work.

- "The perception of the threat varies from nation to nation" (Defense Science Board, 1996). While the United States targets the entire world environment including extreme climates (Farr, 1985), Europeans have

narrower environmental requirements. Furthermore, the United States tends to undertake riskier programs, and partners often differ greatly in technical capacity.

- Don't try "too hard to look for one solution to satisfy all requirements" (*Business Week*, 1997). "[Since] you can't give orders to other countries, avoid a dictatorial approach, get consensus." Be aware of nationalism, sovereignty issues, and personal pride.

The fight for commonality is a long process. While "there's a lot of advantages in being the biggest and the best," a flexible approach is likely to have the most success, especially considering differences in language, perspectives, and terminology. Keep the team focused on identifying similarities and differences; avoid getting sidetracked by support functions and specialist views. Only a generalist approach is appropriate for trading off amongst specialty desires or needs.

**"When walking through the issues to determine the hard spots, look for unknown disagreements...."**

Since costs must be evaluated against requirements, prioritization is essential. Operating and acquisition community views must both be considered in order to achieve a program that adequately satisfies common needs but is also a "doable do" as far as implementation. Understanding the cost impact of specific requirements often greatly facilitates resolution of differences. Goals versus thresholds can be useful, especially considering that eventually the acquisition program baseline will contain these as well as cost as an independent variable, schedule, technical, and other requirements. When examining the issues to determine the hard spots, look for unknown disagreements ("what we don't know that we don't know," á la the Johari Window [Mink, Schultz, and Mink, 1979]) as well as "conflicts of agreement" (Harvey, 1988). It's better to identify problems early ("pay me now or pay me later").

It's easier to do one issue at a time. Historically, many problems arise because of a lack of understanding. Simplify the problem in a "horsy-ducky way"—when you see it, you understand it. Perceptions are important; they define reality. Don't confuse nonrational approaches with irrational ones. Different nations have different Myers-Briggs personality type indicator preferences (Pollock, 1995), and approach problems and solutions differently. It helps to sincerely try to understand why a nation wants a particular requirement. "Ninety percent of problems vanished once they were understood; get outside experts for the other 10 percent." Mitre, for instance, was quite helpful in resolving problems, and some other countries also have federally funded R&D centers.

Some of the overall cost savings of cooperative programs go toward delivery of certain requirements that particular nations don't need. The prime rule of systems engineering is: "Optimizing the whole de-optimizes the parts; optimizing the parts de-optimizes the whole." Work to optimize the whole.

Enthusiastic discussions and brainstorming are ideal, but avoid heated arguments. One may have to resort to higher level leadership to get unstuck. Project

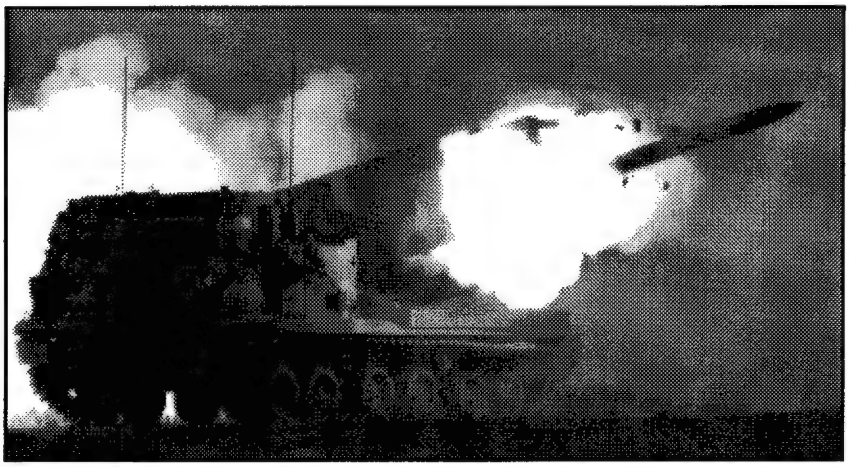
definition and the validation phase cannot be completed until the draft is endorsed at home; one may be forced to back off on an issue when it's staffed. Also, a solid, projected cost and schedule will be needed before participants can commit to the project. Be prepared to introduce wedges into the POM as soon as practicable. If possible, investigate the existence of possible competing programs or engineering changes, especially "black" ones: These have eliminated several promising cooperative efforts (e.g., the Multiple-Launch Rocket System (MLRS) terminally guided warhead) in the past. Avoid late joiners who can and will destroy prior harmonization agreements, and "be willing to be fired a few times!"

## Relations With Foreign Personnel and Governments

"Everybody sees the elephant differently." Understanding another culture is extraordinarily useful when working on international programs. "A nod may mean 'I hear you,' not 'I agree with you' (SAM II History, 1996). Some cultures put the bad news first, some last. Extroverts tend to think out loud, introverts do not. There are large cultural differences between us and even our closest NATO allies. For instance, an informal study indicated stereotypical norms for the United States (ESTJ), Germany (ISTJ), and France (INFP). (Pollock, 1995)

For those readers not familiar with the Myers-Briggs Type Indicator™, commonly referred to as MBTI™, this personality profile captures preferences of individuals for how they focus their attention, the ways they like to receive information and make their decisions, and the lifestyles they adopt. Many groups of individuals in a profession, such as engineers, share the same code letters and traits. Some large groups like countries even share similar traits. The terminology is as follows: I = Introvert; E = Extrovert; S = Sensing; N = iNtuitive; T = Thinking; F = Feeling; J = Judging; P = Perceptive (Briggs-Myers & McCaulley, 1985).

Sensitivity to and respect for such cultural differences can greatly facilitate communications and problem solving.



**The Multiple-Launch Rocket System (MLRS)**

Official DoD photo.

Indeed, at higher levels of complexity and ambiguity, a collegial atmosphere works best (Jacobs and Jacques, 1986), because it minimizes the impact of cultural differences. These differences may influence something as basic as a meeting agenda: For example, Europeans may save the important items until last or revisit them at the end of a meeting. Some Americans view this as a negotiation tactic. It is extremely dangerous to project intentions onto a person from a different culture. All too often, we rationalize and fail to analyze our own intentions. As Farr states (1985), "there are too few internationalists who can think with the other guy's hat on."

**"Negotiators, steering committee members, IPO representatives, managers, executives, and politicians are constantly changing."**

Management styles are almost antithetical between Americans and Europeans. The Europeans generally commit funding for the life of the program, do not need to continually defend it, demonstrate patience, and use a macro-management approach. The United States generally commits funds annually (and doesn't necessarily support the profile for even a year), constantly has to defend the program to numerous decision authorities (management, financial, contractual, etc.), constantly revisits all program parameters (cost, schedule, performance, and operability), and micro-manages.

Administrative differences also abound, from U.S. reliance on e-mail (and the push for the paperless office) to the use of 8 1/2 x 11" paper. Not all allies have e-mail, and many use A4 paper. The latter considerably complicates faxes. Faxes are heavily used, especially due to time zone differences. When the MIDS program office was moved as a result of the Base Realignment And Closure (BRAC) Act to San Diego, the Europeans faced a 9-hour time difference for phone calls with International Program Office (IPO) personnel. This greatly limited the daily amount of phone time available.

Despite the many differences, our allies are, first and foremost, people. Thus, it is best to build on shared motivations and demonstrate commitment to high ethical standards (honoring commitments and avoiding end runs). Be prepared for items to move slowly, if only because of the number of communications links (which increase exponentially with the number of participants). Parallel processing often helps, once a reasonable level of trust has been established. Allies do not understand the U.S. acquisition system (a moving target even to experienced acquisition professionals), just as we do not understand theirs. Be prepared to educate newcomers as required.

Negotiators, steering committee members, IPO representatives, managers, executives, and politicians are constantly changing. Their military members "rotate" just as ours do. The cadre of players is continually evolving no matter what stage a program is in. New players carry their personal as well as cultural backgrounds, experience base, values, assumptions, sense of time, and procedures with them. To bridge differences, it is often helpful to identify items that affect others similarly, such as the globalization of industry, declining military budgets, and OOTW.

When there are definite differences in acquisition policy or culture, it helps to

explain what the effect is upon you as well as upon them. For instance, U.S. acquisition reform and BRAC can be understood better when the U.S. representative points out how the changes have affected or are expected to affect him or her—not just how the NATO listener will be affected. Assuming someone will see the light may leave you in the dark.

### Typical American View of Cooperative Allies

"We have more in common with fellow Services in Europe than with other U.S. Services!" This can make a bilateral, same-Service ICRAD very palatable. The U.S. Navy, for instance, has numerous bilaterals (e.g., Trimarran, cooperative outboard logistics upgrade, and surface ship torpedo defense) with the British Admiralty.

On the other hand, there is much chafing in these overseas relationships. The British are known as hard bargainers. Complaints range from the $6 price of a beer in Norway to European block voting. Sometimes European behavior is viewed as offensive (but American behavior is as well). Europeans do not understand the United States' need for flexible schedules and costs or the need for competition (Europe is truly the home of the military-industrial complex, where sole source is a way of life). It is difficult to create a competitive transatlantic consortium when each partner names the source for its country's work share. Only the U.S. portion of the contract is then competed. Other barriers to cooperation include security restrictions on communications with allies (originating from the Defense Intelligence Agency or the National Security Agency, as appropriate, prior to discussions), and "the automatic perception by some that U.S. technology is way ahead of Europe." It's difficult to cooperate when the United States "wants to stay ahead of everyone else." Such attitudes can extrapolate into a "we develop, you buy mentality" hardly conducive to cooperative development or even to coalition warfare (Farr, 1985).

### Typical Allied View of Cooperative Americans

To potential cooperative partners, "having the United States is a great prize but difficult to work with; rigid." Many of the complaints concern the U.S. political system: "The United States has the Buy America Act; there is no Buy British Act." "The United States is reluctant to depend on allies, but wants allies to depend on the United States." Further, the United States imposes extra-territoriality (e.g., no allied trade with Cuba and restricted sales of high technology to South America) to the detriment of allies. Also resented is U.S. arrogance about being the best, and its bad case of the not-invented-here syndrome. Thus, the United States is viewed as protectionist (two items that often arise are certain types of ball bearings and textiles).

**"Rather than trying to force something down NATO's throat, the United States could seek to understand NATO goals."**

It might help if the United States opened the North American Free Trade Act to Europe. The Western European Union may act to counter U.S. protectionism. Europeans "want to avoid a one-way

superhighway of sales to Europe versus true partnership" (Farr, 1985) and avoid "a country lane going west and a superhighway going east" (Abbott, 1997). The Defense Security Cooperation Agency (DSCA) is seen as promoting U.S. exports via foreign military sales, which is viewed "like Japan dumping cars in the United States." This parallels a perceived attitude that "if it's good for the United States, it's good for NATO." The United States needs better credibility as an honest broker. Rather than trying to force something down NATO's throat, the United States could seek to understand NATO goals.

Loyalty to one's country is often viewed as "nonparochial." Work share and offsets are viewed as strengthening a nation's industry and economic base, which are essential for a strong military. French rivalry with the United States is based upon similar ambitions; she sees herself in direct competition with the United States as the European defense technology leader.

**"To offset these perceptions when dealing with allies, the United States must exhibit a cooperative attitude instead of a nationalistic, self-important, or superior one"**

But much of the difficulty concerns differences exacerbated by the lack of international experience of U.S. personnel. Indeed, the United States, it is said, "has a teenager viewpoint." The United States wants total defense capability across the spectrum, wants the allies to help pay for it, and wants continual upgrades (e.g., the F–16)—forcing allies to spend more or become incompatible. "It's inefficient for the United States to seek dominance in everything."

Furthermore, the U.S. acquisition system gets its share of complaints. "The U.S. system is full of lawyers" (and has a regulatory mindset); requests for proposal (RFPs) allow only 60–90 days for contractors to respond, but it takes the U.S. State Department 60 days to release the RFP to allied bidders; the United States presents a veto problem for third party sales; and cooperative efforts get "ambushed by the many," a reference to the large number of players in the U.S. approval process (Kwatnoski, 1995).

To offset these perceptions when dealing with allies, the United States must exhibit a cooperative attitude instead of a nationalistic, self-important, or superior one. The United States' widely broadcast exuberance over becoming "the only superpower" reminds one of the fans at a ball game chanting "We're number one!" When the United States unilaterally cancels cooperative programs, replacing them with national ones (e.g., brilliant anti-armor submunition), France needs no excuse to leave MEADS and pursue its own national program. It's little wonder that Kwatnoski's survey (1995) found allies stressing trust and commitment, but Americans not (similar to Farr's findings [1985] on European versus American commitment). Nevertheless, recent military down-sizing, industrial consolidation, and other trends provide an opportunity to increase understanding, cooperation, and competition. For instance, it was noted that "the Atlantic is narrower than the English Channel in some respects," and that "it serves no purpose to protect companies that are basically noncompetitive" (American Defense Preparedness

Association, 1997). But international competition must also be open and reciprocal to be politically defensible.

## Memorandum of Understanding Development

An MOU, from first draft to final signature, can take anywhere from 2 months (minimum according to the NIPO) to 26 years (maximum according to the Defense Systems Management College). A reasonable planning estimate is probably about 2 years, though there are new procedures to accelerate this process. Prior execution of a DEA amongst the partner nations can greatly facilitate this process. Before beginning, the requirement should have been defined and harmonized, the participating nations' representatives identified, and the type of agreement determined. These representatives (principals) either will form or represent a steering committee (SC).

Generally, technical discussions take place prior to formal negotiations. These discussions cannot decide anything and cannot draft MOU language, since these responsibilities are reserved for designated negotiators (such as those in the NIPO). However, principles of cooperation (POC) are defined during technical discussions, which are the basic approaches underlying the resulting MOU. While not binding on the negotiators, they serve as guidelines for negotiation. They should have a consistent thrust, forming a "thread through the document more important than the exact words of the text." Usually the POC are written in the form of a list, worded in a nonbinding manner: "The participants intend (or seek) to...." They are often drafted by program personnel.

The basic structure must also be chosen. Many MOUs are written as stand-alone documents addressing an individual program phase (e.g., engineering and manufacturing development), although paragraphs from prior phase MOUs may be incorporated by reference. There are, however, alternatives. Program MOUs (PMOUs) provide a standard framework for the life of the program with supplements specific to each program phase. The initial supplement is negotiated with the PMOU. Thereafter, only phase-specific issues need be negotiated for later supplements or phases. More recently, technical R&D projects have been instituted with country umbrella agreements and project annexes. These annexes can take half the time of a regular MOU, and their small, early R&D projects can be delegated to the SC for signature.

**"'Many MOUs are written as stand-alone documents addressing an individual program phase (e.g., engineering and manufacturing development)...."'**

MOUs for larger programs may be signed by the national armaments director of each nation: In the United States, this is the USD(A&T), but signature authority can be delegated to service acquisition executives for smaller programs. The DoD international agreements generator (IAG) software program (developed by the NIPO) is available to MOU authors. The executive secretary of the SC may compose the first draft using the IAG and POC. The NATO Group on Acquisition Practices (AC313) has promulgated

"Guidelines and Sample Provisions for Memoranda of Understanding," containing language similar to the IAG. The IAG contains actual paragraph wording for MOUs with numerous alternatives included. The Defense Systems Management College program manager T304 course (Advanced International Management Workshop or AIMW) trains personnel to write and negotiate MOUs; it is highly recommended. Service experts (such as NIPO) can provide prior MOUs and information on the latest options (e.g., the joint strike fighter's core master agreement approach). While prior MOUs can be quite helpful, they have already been negotiated and, therefore, are not well constituted as going-in or opening positions, since they are already reflective of compromise.

**"'Lawyers are important but the program manager must lead and set the tone.'"**

Prior to negotiations for the initial draft MOU (for an R&D project), a summary statement of intent (SSOI) must be formulated, submitted, and approved. The SSOI generates, hopefully, authority to negotiate that is formally approved and forwarded to the U.S. principal. Service specialists run interference for the approval process, but one must communicate the nature of the project to them so that the right people are assigned to the project. They also lead or staff the negotiations delegation (including legal experts), along with the principal's technical representatives. Thus, it is necessary to explain the unique nature of the project to the MOU specialists, for which a mutually supportive and well-coordinated IPT is ideal. Vision, goals, and objectives can then be shared and refined. The United States' going-in position and ranges of acceptable outcomes can then be devised. "Lawyers are important but the program manager must lead and set the tone." "Lawyers want rigid structure, but you need flexibility to adapt to changes; funding per year can't be fixed." But "One word crafted by a lawyer is worth a thousand pictures." In any case, MOU experts serve as "your encyclopedia." It might also be helpful to peruse the DUSD(I&CP) *International Armaments Cooperation Handbook* (1996) for a process overview.

## MOU Content

Regarding the initial draft, a balance must be struck between a strong opening position and what can fly. An unrealistic starting point not only slows down negotiations, but detracts from credibility and a perception of equability (a U.S. statutory requirement). Use consistent terminology and provide written definitions, and try to avoid multilingual documents—language certification can cause delays and misunderstandings. Create a Rich Text Format file as well as a word processor file and maintain them on diskettes, use the "Keep it simple, stupid" (KISS) principle, and "wallow in the document." Obtain an OSD cheerleader who can facilitate the entire process and be a program advocate—especially if the program is or may become joint. According to a number of those interviewed, the big five challenges are: management structure, finance (including cost share), contracting (including work share), information disclosure (and use), and third party sales

and transfers. But any area can present problems with a particular nation. Most important, extrapolate results of any agreement: "Those who write the MOU don't have to execute it." Use authority responsibly. Use the Porridge Principle: neither too hot nor too cold (not too vague, not too detailed).

Depending upon the size of the program and the particular nations (and number) involved, an SC will oversee the program (a principal and deputy per nation), supported by an IPO. Usually, the United States serves as host nation (providing nonreimbursed support, the SC chair, program manager, and executive secretary), with the IPO (including international representatives) located in the United States. This is optimal for efficiency if the overhead is affordable. Avoid overly predefining positions to be occupied later by internationals (other than the deputy program manager), since they will probably be unfamiliar with the U.S. acquisition system.

In most programs, each nation gets one vote and all votes must be unanimous. This provides veto power, which can be highly detrimental in certain cases, especially if used as a threat. In some cases (e.g., Sea Gnat), however, voting situations have been divided into classes with some critical areas retaining the veto and others being decided proportionally (e.g., by cost share). Since the United States often provides a disproportionate share of the funds (more than 40 percent for some large projects), this is highly desirable.

Configuration management (including software maintenance) is also an important issue since interoperability is a major ICRAD advantage. Authority can be vested in the IPO and SC as appropriate. The program manager must have veto power over IPO appointments (though it must be used sparingly) and sufficient authority—don't strangle the program manager! Provide as much authority to the SC as possible. Often agreements can be relegated to subsidiary documents (such as the program management plan) controlled by the SC. Also, acceptable ranges can be preset, with the SC empowered to approve targets within the accepted range (similar to U.S. acquisition program baseline goals versus thresholds). It is very important to avoid later problems by defining program officials' responsibilities beforehand.

Payment in U.S. funds is important. The MIDS, for instance, had the nightmare of five currencies with bank accounts in each currency in each nation. The five subcontractors were paid in their own country's currency. There was a considerable price paid in terms of time delays, personnel, and overhead.

**"Foreign industries are often not independent of governments, and true competition is often nonexistent."**

Exchange and inflation rates also become challenges. Equitable cost sharing is subject to considerable interpretation. Europeans often wish to match each nation's projected off-take (number of equipment units to be delivered) percentage to their cost contribution. But many operating costs are not dependent on the number of units, and the host nation alone pays for many items. Some programs have devised a two-tier approach: Some cost items are shared equally and some are by off-take percentage. Of course, the MOU must define items by category.

In addition, a national versus common or shared cost category is necessary for items not desired by all participants. Engineering changes are a special case; some MOUs provide that only those nations requesting the change pay for the nonrecurring costs, but all nations pay the recurring costs. These approaches are theoretically satisfying, but caution is advised since not all nations are necessarily forthcoming or accurate regarding their projected off-take or desire for a specific engineering change.

Contracting is presently in a state of flux. U.S. acquisition reform efforts include new contractual agreements, such as use of commercial products and specifications, dual-use manufacturing, the single process initiative, and electronic data interchange. Not all potential partners, however, are familiar with, or capable of handling all of these innovations. Be prepared to explain and defend them. Foreign industries are often not independent of governments, and true competition is often nonexistent. International consortia are probably unavoidable, with most nations specifying their participating company.

**"Third-party sales can be a thorny issue in production, although it is also included in engineering and manufacturing development MoUs."**

Also, work share will indubitably be equal to cost share. However, it is highly recommended that error factors be used—that is, each share should have a range of acceptable values or an accepted percent of deviation (e.g., 20 percent). Also, while the SC will review the actual figures against targets, the prime contractor should allocate the work under the given guidelines. An award or incentive fee can be invoked to motivate compliance. If possible, have the prime contractor or integrator excluded from work share.

Assignment of specific assemblies or software can be a problem, since companies vary in abilities. Often, firms with less experience in an area will lobby to perform that task (as a technology transfer benefit; one of the main reasons foreign nations collaborate), which can add enormous technical, schedule, and cost risk. Be prepared to fight to have work share distributed on the basis of capability. "Work share is more art than science; get companies to work on it." A government-industry team may help.

The roles of the SC and IPO in contractor selection must be predefined. IPO reviewers will need the education necessary to fairly evaluate bidders in accordance with host nation laws and regulations. The SC should review IPO findings and recommendations, but should *not* have selection authority. The SC chair (the program executive officer) may be the selection authority, but the final decision may require higher-level (Milestone Decision Authority) review and approval. However, in some cases the participants choose to use NATO contracting rules or a NATO management agency, which greatly complicates matters.

"Foreign disclosure policy can be the long pole in the tent." Partners are just as interested in information as in hardware and software. Background information produced by a nation outside the program (usually prior to) can be used, if provided to principals or contractors, but not

released outside the program. This must be delineated in the MOU.

Foreground information (produced by the program) can generally be used by participants outside the program, but specific allowable uses can be specified. Government use property rights are becoming acceptable to collaborative partners. It is important to protect U.S. companies from losing control of their intellectual property rights. Legal personnel should assist here.

Third-party sales can be a thorny issue in production, although it is also included in engineering and manufacturing development MOUs. The United States generally insists on veto power in this area, though caveats (stating that a veto would not be invoked if the partner in question would sell a similar item to the target country itself) can be included. Unfortunately, the State Department reviews these on a case-by-case basis, and the countries on the no-sale list vary over time.

The United States is usually the only one to object to these sales, but not always. Embedding U.S. or cooperatively developed items into a foreign platform can detract significantly from their competitiveness. Swedish fighter sales were held hostage due to U.S. component export license requirements.

Indeed, one must run interference with the State Department for the shipment of collaborative components between partner nations for incorporation into the integrated product. Export licenses will be required. It is possible, however, to negotiate a blanket export agreement with the State Department before the fact. Service laboratories also must be coordinated; export licenses have been hampered in the past when a laboratory was asked to evaluate technology export unbeknownst to the program manager.

Some programs use a coordinating committee to control third-party requests. Such a group could function as an OIPT, with State and Commerce Department members, to facilitate approvals. Also, it may be possible to negotiate with State for a "quick look report" on proposed releases, consortia agreements, RFPs, or technical assistance agreements to speed up the process. Other possibilities include leasing and licensing (one example of this is the multiple launch rocket system for Japan).

## MOU Negotiations

It pays to plan ahead. Find people with an international background and the necessary technical and management expertise, and line up a professional negotiator and lawyer. Get current data on each country's recent negotiations history and identify a solution in advance. Often, "if no one has an alternative, you win." The initial draft (with backup rationale) is the going-in position, but one should also prepare contingency plans, acceptable ranges of outcomes, and a "best alternative to a negotiated agreement" (Fisher and Ury, 1983). It helps if acquisition personnel have people and negotiation skills. "We can't afford potty training" for expensive programs: "Come equipped with the tools to do the job." A politically sensitive strategy must be devised and

**"Everyone needs to feel they're part of the solution."**

major strategy changes must be avoided. Rather than a group with divergent interests, one needs a small, coordinated team. The resulting "comprehensive vision" and coherent view, ready for an opportunity to open, "won the day time after time."

During negotiations (as in running an SC or IPO), attempt to establish mutual trust through personal relationships. Don't try to intimidate; "don't be Attila the Hun." Compromise as necessary. "Trust is a two-way street." "Everyone needs to feel they're part of the solution." Avoid being labeled "uncooperative." The United States usually provides administrative support. Beware of transmission problems (phones, facsimile, e-mail) and the limitations of the partners. Provide soft (electronic) copies so they can adjust the verbiage as needed. The goal is to "create a winnable program" for all the players. Scheduling sessions will be a continuing problem, so schedule them as far in advance as possible. Lack of continuity of negotiators, both foreign and American, will probably plague the process. It is recommended that sessions be held monthly. The number of sessions generally equals the number of countries.

**"Don't get stuck, move on; seek later tradeoffs or unknown, evolving, integrative solutions."**

It's best to divide the effort into "doable chunks" similar to evolutionary acquisition. Don't get stuck, move on; seek later tradeoffs or unknown, evolving, integrative solutions. For instance, funding or work share can be temporarily "fenced off" for later discussion. "Steer the language through terrain obstacles," and modify the principles of cooperation if necessary.

But do not revisit prior MOU agreements; times have changed and the climate differs. Partners may bring up every concession the United States ever made on any and all prior negotiations. So avoid setting new precedents for their later use: For example, don't go above the AWACS 41.5 percent cost share. Breaking new ground will have future consequences. Nonetheless, it may help to ask another nation to draft a proposal and then defend it. One then has buy-in and is not seen as the constant driver of the process. This technique often exposes heated differences as mere linguistic difficulties. When another country proposes verbiage that seems identical to what the United States previously proposed, *never* say "that's what we said before." Just thank them for clarifying the issue. Most of all, don't lose sight of the goal.

## MOU Approval

Kwatnoski (1995) noted that "nearly all the U.S. project offices identified the cumbersome MOU-MOA (Memorandum of Agreement) process as a barrier to cooperation, including complaints about staff coordination differences and the time it took." Times are often significantly underestimated, especially when higher level changes necessitate reopening negotiations. Reviewers have their own agendas. DSCA, with a vested interest in foreign military sales versus ICRADs, can harm a program (the MLRS suffered this fate).

Similarly, the Defense Threat Reduction Agency, the National Security

Agency, and the Departments of Commerce and State will also review the MOU, greatly lengthening the process. Preprocessing choreography can provide an ounce of prevention, however. Unfortunately, acquisition reform has not yet improved the chop review cycle much, except in OSD, where the average review time has significantly declined. Beware that "sometimes the wrong people are staffing the problem." A silence procedure is needed for all parties concerned, and an OIPT could be very useful as well.

Finally, don't negotiate if a program doesn't have a pressing Service need and is already in the POM—if not in the Future (formerly Five) Year Defense Plan.

## Steering Committee Operations

SC membership is somewhat enigmatic. Sometimes the U.S. member will have the highest rank and the smallest authority. Most other nations have much smaller bureaucracies and avoid micromanagement. Hopefully, the MOU will apportion considerable authority to the SC. The U.S. member should have at least as high a rank as the other members, despite the fact that one cannot control who else serves on the SC, and "everybody wants to come to the United States." Assuming the MOU appoints the United States as the host nation, the SC will normally elect the U.S. representative to chair the SC. In most circumstances, majority does not rule; each nation has veto power. Therefore, the chair needs finely honed people skills or it "may take forever to do anything." Especially avoid going in "with extra baggage, stereotypes, or prejudices." Rather, "be prepared to listen and learn; be open minded; have fun."

International experience and negotiation skills can help minimize politics and maintain a professional atmosphere. It's important to establish a culture of cooperative problem solving rather than one of competition, so that all members feel they are full participants. Familiarity can breed mutual respect. Experience with group dynamics can help the chairperson establish a collegial partnership (Jacobs and Jacques, 1986) in which the members support each other and feel safe enough to openly express their nation's core concerns and issues. Similarly, the chair needs to work the external environment well (i.e., public relations) for continued support of the program. Strangely, to obtain a uniform SC vision, the chair must understand the many cultural, personal, time sense, and technological differences. For instance, the technical to management ratio of SC members may vary considerably. International team building is a challenge.

**"In most circumstances, majority does not rule; each nation has veto power."**

The one team member that the chair can appoint is the executive secretary (ES), who administers SC operations. This position is important since "he who writes the results of the meeting determines its outcome." Also, the ES prepares the agenda, which should be pertinent to the program and avoid extraneous issues. Succinct minutes should include attendee list, action items, agreements, slides not available for handout at the meeting, and

## Steering Committee Meeting Checklist

I. Before the meeting (United States as host)

A. Correspondence
1. Read-ahead package: Agenda, preparation items; prior action items (AIs); location and room
   a. Avoid acronyms; date and number pages or identify same as ahead package
   b. Make extra copies for duplication into meeting handout packages
2. Attendance list for meeting
3. Security clearances (if meeting is classified, need foreign visitor request forms)

B. Reception planning
1. Reception attendance list, including contractors
2. Official representation funds (ORF) request letter
3. Location choice, deposit, reservation
4. Cost analysis and distribution
5. Invitations: Write and send; contribution addendum?
6. Contractor reception? U.S. attendees?

C. Presentations: Transparencies and hard copies
1. Current action items with spaces for additions
2. PEO pitch: Avoid acronyms and idioms; prepare a bio and introduction for any new participants
3. IPO pitches and read-ahead items; MIDSCO?

D. Room selection: Consider number of participants when chosing size and shape
1. Arrangement of furniture (including coffee table): in back and near door

II. For the meeting (prepare just beforehand)

A. Handouts (take-along packages): Avoid acronyms and idioms
1. Looseleaf books with decal markings and members' names
   a. Numbered dividers matching the agenda
   b. Inserts: Agenda, table of contents, current action items with blank spaces
   c. Read-ahead package updates and additions: Reports, pitches with date and page number
   d. Appendices if required
2. Welcome packages: Maps, brochures, metro information
3. Sign-in sheets ("please print") with headers and latest data on members

B. Security
1. Foreign visitor request forms (to host activity security office)
2. Pre-made badges (visitor control office)
3. Escorts for foreign guests

C. Room setup
1. National flags, participant placement
2. Numbers of chairs at table and against wall; arrangement of furniture
3. Coffee, pot, filters, cups: location in relation to tables, doors
4. Doughnuts, cookies, and cold drinks (for the afternoon)
5. Vu-Graph machine, screen, blank, elex slides, marker pens, MOU, pointer
6. Calculator, computer, printer, MOU, elex slides, power availability
7. Blank slides and slide markers; pointer

III. At the meeting: Action items, decisions, cleanup (coffee pot, etc., at end of each day)

IV. After the meeting: Minutes, attendance list, AIs, next meeting time and location, decisions

little else. Other items are generally "a waste of time and money."

The ES must be sensitive to time differences between the U.S. coasts and the foreign members. Opportunities for phone calls and video teleconferencing are limited, and Federal Express deliveries to specific individuals within other countries can be elusive. Some principals may not have reliable e-mail, and posted mail takes forever. Thus, many programs rely on facsimiles. Sometimes members trade home phone numbers. It's important for the ES to provide signup sheets for each meeting, since numbers and titles change continually. These can be pre-printed with room for corrections. A sample checklist for host nation meetings is shown in the box on the following page.

Meetings held in other nations would require a subset of these actions, with added actions for area clearances and other issues. Some nations that require no visa for tourists do require one for those traveling on official passports. U.S. Embassy Offices of Defense Cooperation will usually make hotel registrations for official visitors (they get better rates). On some programs, the principals even put up visitors in their homes or have social events for the SC. Generally, the hosting nation (for a particular meeting) will host one social event for the principals, deputies, and sometimes other attendees. Welcome packages with local event, travel, and restaurant information are normally provided. The ES should verify what equipment (such as computers, word processors, printers, fax machines, and vugraphs) will be provided at the meeting.

The chair needs to "lead, not just run the meetings; to work the hard issues." To maintain a corporate perspective, the principal needs to strategize with group members: deputy SC member, program manager, and ES. Each may be asked to draft inputs for the meeting. Often one of the inherent costs of ICRADs is training the internationals—whether in the SC or IPO. While some of this is necessarily on-the-job-training, SC meetings should be used to "consider issues, not to inform the members." Read-ahead packages should be sent so that members are informed of details prior to the meeting. Though drafts may be sent ahead for review, always bring copies to hand out at the meeting. Important items can also be included in the minutes.

**"While nations may play one principal off against the other, appreciate the differences."**

The meeting itself should be run as a board of directors meeting, with a high level of abstraction. Technical issues can be delegated to a multinational management coordination group, under the program manager, which reports to the SC. The SC should also avoid micromanaging the program manager or the IPO. Both formality and the number of attendees should be limited (one program had 100 attendees!). Meetings can be broken into parts: principals-only sessions and plenary sessions. During the SC meeting, "Who speaks first matters. Know which countries have similar positions and arrange the order of speaking." It's best to go last. "If the United States votes first, [the other members] tend to vote against the United States." "Avoid flexing your muscles." Clearly identify and record open and closed issues and agreements. Above all,

avoid public infighting. If disagreements appear among U.S. attendees, call a recess.

The contractor should be invited to speak, but must avoid implying that he or she represents the United States. Europeans have much closer interrelationships with their contractors, and they may not realize the difference while listening to the contractor's report. The program manager should provide a government view of the contractor's performance. While nations may play one principal off against the other, appreciate the differences. "Differences don't equal right or wrong." And remember, "you gotta have fun!"

## International Program Officer Operations

Many of the issues asynchronously confronting the SC chair synchronously confront the program manager, making it a frustrating full-time job. While "it's orders of magnitude more difficult to have an IPO than a major U.S. program," say program staff, "familiarity breeds appreciation." For small programs, added costs may not justify an IPO, but there's a huge difference between "an integrated office versus token representatives." An IPO can bring "a sense of family" to a program. The program manager can promote this climate by showing "loyalty to the project versus your country [to] promote allegiance from others." If successful, "you don't hear their accents anymore" (Klisch, 1997).

**"Conversion rates can affect overruns and losses and add risk to funding profiles."**

### Technical Issues

While DEAs rarely lead to MOUs (one did for Trimarran), DEAs are recommended while a program is becoming a reality and even after the MOU is signed. They provide a convenient way to communicate. Furthermore, personnel gain valuable international on-the-job training. Similarly, the Engineer and Scientist Exchange Program and international military exchange training can provide personnel experienced in working with allies on technical and operational issues. Prior to MOU approval, personnel should finalize technical requirements (see above) and translate them into working-level documents. Most especially, the interface control documents must be collaboratively generated. Be aware that technology transfer issues may be more difficult than envisioned. Use of U.S. laboratories may be limited to host nation support unless foreign laboratories can provide balancing support (and an independent view). Use of support contractors and federally funded R&D centers may also be limited because of funding. IPO operations can be streamlined through electronic media and other acquisition reform measures.

### Financial Issues

As in all programs, funding continuity is a challenge in the United States. With several cash flows (from different countries) to manage, ICRADs do increase the financial manager's burden. As stated above, funding is more solid if based on a core Service requirement. "Service people don't care that you have an international MOU; they only care about their pet projects." One program had its Service funds pulled 2 days before the MOU was signed. If Nunn funds, for example, are

used to start a program without strong support, future funding streams are imperiled.

Even with strong DoD and Congressional support, programs such as the mobile extended air defense system have had rocky financial pictures. Nunn funds are usually provided for only 2 years and must be spent in the United States. Program funds (especially for joint programs) are sometimes funded by DoD versus the Services (e.g., MIDS terminal), which can help to fence funding lines. As always, the program manager and program executive officer must be strong program advocates to maintain program continuity. Having a discrete reserve or engineering change proposal account is highly advisable.

Antithetically, foreign funding is much more stable—but foreign funds have their own problems. Conversion rates can affect overruns and losses and add risk to funding profiles. De-escalation indices are very difficult to negotiate if they are not pre-set in the MOU. Business, accounting conventions, and tax structures all can differ. All known national budget processes are out of phase with the United States' October 1 fiscal year starting date and planning, programming, and budgeting system cycles, and "the normal U.S. system does not accommodate international transactions well."

It's best to get payment in dollars, but if that is not possible, get an internationally experienced bank or accounting firm to handle financial transactions and currency conversions. It can also help to have the nations send funds directly to the contractor. Many countries (Britain among them) are much more flexible at exporting funds, but in the United States, it is "hard to send money overseas." As an alternative, the United States can provide test gear or used equipment or other items to avoid sending dollars abroad.

The financial manager will need to follow up on deposits and expenditures—don't assume they will occur as planned. Beware that large checks can sometimes appear in the mail—with your name on them! A financial manager in each nation may be needed to help develop methods to tailor standard procedures in each country. An SC-approved financial procedures document can provide continuity of method over the life of a program. Of course, the size (ACAT) of the program will dictate how elaborate procedures need to be. Remember, however, that "losing money doesn't take any great skill—anybody can lose money."

**"When obligating and expending funds, it's important to differentiate between common, host nation, and national costs."**

When obligating and expending funds, it's important to differentiate between common, host nation, and national costs. Make sure checks are made out right and not lost. The system is bureaucratic, but not automatic. Foreign funds may be designated "operations and maintenance" or "production," but the usual rules (e.g., expiration dates) do not apply. Comptroller personnel may need to be reminded of this peculiarity. While the United States obligates funds, then pays when billed by the contractor, other countries may have a work-first, get-paid-later, or a pay-bills-up-front approach. Such differences should be accommodated in the financial procedures document. It can also be used to institutionalize contingencies for inflation, unit cost changes, or unit vol-

ume changes. Differences in fiscal years can sometimes be used to add flexibility to funding and cash flow. Using work-share banding for contractors and field activities can increase vital flexibility which may become critical, since getting useful cost-schedule reporting data can be a tremendous—and expensive—challenge. On the bright side, "no one looks at non-U.S. funds in the DAES [Defense Acquisition Executive Summary, an ACAT I report to DoD] report."

### Contractual Issues

While it's best to have a real prime contractor with experience (e.g., Hughes for the evolved Sea Sparrow missile), many programs end up with a unique consortium (e.g., MIDSCO for the multifunctional information distribution system (MIDS) Consortium Organization. Contractually, pure competition obtains the best price, but the nations will want to divide up work share among a selected group (usually one company per country). It may be possible, however, to have competing primes enlist their own subcontractors within the partner countries. Indeed, a particular company can be split up by a "Chinese Wall" so that different divisions join different transatlantic teams without sharing bidding information. To better accomplish this, MEADS formed "transatlantic international entities." Of course, losing bidders may mean losing some of the best subcontractors, but this is just as true in domestic team bids.

**"Most important is to 'create an environment the contractor can win in;' and avoid close supervision and continual 'help'...."**

Rigid work-share percentages preclude needed flexibility and are unrealistic considering the vagaries of time and programs. It's best to provide the prime contractor with subcontracting flexibility and empowerment to ensure that a work-share target (within specified bounds) is achieved. An award or incentive fee can be imposed. "Assigning work is dicey." Care must be taken that performers have the capability and expertise to efficiently and effectively perform the tasks assigned them. They should not receive work merely because they desire it.

Europeans usually employ fixed-price contracts; their budget system reflects this. U.S. cost-plus contracts present a major risk if not understood. Cost schedule reporting, design to cost, and life-cycle cost may be unfamiliar concepts as well.

Protest mechanisms (e.g., by the General Accounting Office) should be delineated prior to issuing the solicitation. Acquisition reform efforts, such as commercialization, can somewhat offset such problems and can lower risks. The many differences underscore the difficulty in obtaining foreign expertise in U.S. contracting. NATO contracting is possible, but seldom desirable. But the use of contract innovations can be quite helpful. Companies can establish facilities on foreign soil; international credit arrangements can be devised; or, perhaps, work share could be pooled in a group of projects or contracts.

Most important is to "create an environment the contractor can win in;" and avoid close supervision and continual "help" (like DoD sometimes receives from the legislature). For instance, allow the prime to work out conversion and escala-

tion rates with subs. Obtain exemptions, waivers, or deviations to help the program. Recent developments such as the McCain Amendment can help with the Buy America Act. Often there are ways to work around technical export restrictions, specialty metals clauses, and other regulatory difficulties. Unfortunately, despite the Administration's efforts, U.S. export license reviews remain a lengthy process. Learning curve delays, however, can be eased through out-sourcing, but keep support contractors to a minimum. It's difficult to get them (and even DoD laboratories) included as common (shared) costs. Issues should be resolved in the IPO if at all possible. Minimize issues passed up to the SC for resolution; otherwise expect significant time delays. A management coordination group can help resolve issues before this occurs.

### Personnel Issues

IPOs require personnel who can handle more ambiguity (Jacobs and Jacques, 1986). One of the ways to lessen ambiguity is to define roles that people can "own," rather than having them merely serve as national liaisons. One can try to obtain experienced people to avoid much on-the-job-training, but it's "hard to find U.S. personnel qualified for cooperative programs, let alone European [personnel]." Despite MOU authorization to approve all IPO personnel, the program manager can reject but a few (at most) without creating unacceptable embarrassment.

The resulting group may demonstrate great variation in ability and training. Comments from participants are hardly enlightening: "Everybody wants to come to the United States so you can get their best people." "Only a few of them are willing to move to the United States; therefore, there are small selection possibilities." Still others say that because of the vagaries of politics, "they don't always send the best people." In addition, with smaller organizations, differences in levels of detail and abstraction between GS–13 and Senior Executive Service equivalents can be much less in other nations as can their use of consensus management. Despite off-take (number of units procured) and cost-share (amount of funds contributed) differences, partners generally choose to send an equal number of people to the IPO, most of whom have "little knowledge of U.S. acquisition and contracting methods."

**"Technical expertise is a bonus, but sound management experience is a must."**

In addition, foreign military and civilian personnel are subject to the same job rotations, promotions, and retirements that U.S. staff are, so that staffing the IPO can be a constant problem. Since the deputy program manager is generally from a partner nation, the program manager cannot rely on a civilian deputy to take care of personnel issues. It is useful to appoint a senior U.S. staff member with supervisory experience to help. In this situation, it is best to use experienced managers. "Technical expertise is a bonus, but sound management experience is a must." Thus, it is also best to "avoid U.S. people who need to learn acquisition"—there will be enough internationals needing to do so. It was even suggested that the "United States should fully staff the IPO [using host nation support] and use Europeans as you

can."

Less extreme solutions are also available, however. Certainly, the program manager "needs to be a good trainer," to understand the individual's strengths and weaknesses, and to perform "situational supervision." In addition, European personnel should be encouraged to arrive early (especially to a newly formed office), and IPO personnel can attend numerous acquisition courses, including international courses at the Defense Systems Management College. Kwatnoski stresses the need for U.S. personnel to understand international agreements, especially those relating to intellectual property rights (1995). Also, the program manager can get the whole IPO up to speed on important issues via group training and team building. Group trips to field activities can be arranged to help establish a shared knowledge base, and foreign sponsors or training communities can be invited to visit the IPO.

Dissension (e.g., argumentative team members) may be avoided to some extent by screening; however, problems can also be avoided if they "live together, so honor is not on the line over disagreements" (D'Agostino, 1996). The program manager can teach by example, demonstrating give and take versus trying to win every battle. The goal is a seamless team that puts the program ahead of parochial national interests. Residual learning curves for specific expertise deficiencies can be handled via outsourcing. A fresh view can be quite helpful. "Be prepared for jealousy from people not working international programs," but "don't miss the wind of change."

**"U.S. members need to avoid a bureaucratic mindset, second-guessing and micromanaging other players, including contractors."**

## Management Issues

International programs face all the challenges of domestic programs and then some. Certain aspects become particularly important in multinational groups. "The international acquisition manager is a consensus builder dealing with a plethora of naysayers far exceeding that found in domestic programs" (Kwatnoski, 1995). To instill mutual trust, the program manager must display a win-win attitude, instead of viewing the collaboration as a technical giveaway. The goal is to build a group culture that views the program as shared, with the internationals as coworkers, and to avoid a culture that is national in flavor, with liaison representatives viewed as outsiders. "European members must be equal to U.S. people." When members trade home phone numbers, someone's doing something right!

U.S. members need to avoid a bureaucratic mindset, second-guessing and micromanaging other players, including contractors. Unfortunately, "the European process is similar to U.S. processes five years ago," and "most people you deal with [in the United States] don't appreciate the international program." For instance, MIDS had problems with badges for foreign IPO members, especially for after-hours work. The program manager had to invent special "Blue Badges" to identify and allow after-hours access for international IPO members. Also, be aware that some countries don't have a

"confidential" classification, so they have a tendency not to safeguard confidential materials. Furthermore, management is the stock and trade of generalists; "specialists can't be allowed to run the program." Resist being handcuffed with overly detailed requirements.

Specific expertise can be retained or enlisted as needed. Resistance exists to using only U.S. field activities or federally funded R&D centers, but other countries (such as Australia, Canada, and the Netherlands) also have them. Of course, the size of the program is important for determining IPO size and structure, the nature and oversight of the contract(s), Congressional visibility, and how quickly things might be accomplished (e.g., the X–31 was done in record time). Your schedule risk will rarely be less than medium; however, risks can be mitigated through the use of preparation, experience, and training (PET)—a phrase used by Kwatnoski (1992, 1995). Recording lessons learned will add to the international data base so ICRADs improve in the future.

## Recommendations and Conclusions

If the United States is serious about international cooperation as the technique of choice for the future, it has numerous opportunities to demonstrate its commitment. First, international aspects must be fully integrated into, and in some cases drive, requirements. Similarly, acquisition planning should include the assumption of cooperative development, production, and execution. Likewise, training (formal and on-the-job) for both communities should emphasize cooperation. Obviously, this would entail a major shift in mindset as well as procedure. But that is precisely what the world is presently experiencing with the "relative decline of American power and the increase of global interdependence"(Jones, 1997).

ICRADs need be linked to interdependent, coalition missions with the commanders in chief and joint staff fully engaged if such climactic, climatic changes (as described above) have much chance of success. Many of the necessary changes, fortunately, follow in the steps of recent trends such as defense acquisition workforce implementation act certification, joint R&D and mission planning, acquisition reform, and empowerment. But with the many and continuing "barnacles on the ship of progress," it will be a rough ride.

An alarming tendency exists in the land of the free and the home of the brave to effect change by fiat rather than through motivation and guidance—continued protestations of the pursuit of empowerment to the contrary. The powers that be might consider the old motto of the Philadelphia Savings Fund Society: "Wishing won't do it, saving will." I suggest that the top-down approach be aimed at reducing and eliminating impediments to international cooperation while encouraging and motivating requirements, operations, and acquisition personnel to engage in the cooperative process. Skills + Desire = Product. When priorities, prestige, and promotions go to those succeeding at international cooperation, you'll have to search for another problem. Why? Because without problems, they wouldn't need us!

**Neal Pollock** is the executive assistant for engineering and program assessment to the program executive officer for space, communications, and sensors for the U.S. Navy, and has served as the executive secretary to the multifunctional information distribution system (MIDS) international steering committee since 1994.
(E-mail address: pollockn@spawar.navy.mil)

**DISCLAIMER**

This paper was originally written in partial fulfillment of the requirements of the Senior Executive Leadership Course (SELC) Class of 1998, administered by the Executive Leadership Development Program (ELDP). It was written while Pollock served in an SELC developmental assignment in the Office of the Deputy Undersecretary of Defense for International and Commercial Programs (ODUSD[I&CP]). It does not necessarily reflect the opinions of either office.

**REFERENCES**

Abbott, G. (1997, June). *U.S. and Transatlantic Cooperation in Armaments: Theory*

*Practice and Promise* (Rappport/Report BI SEAS:D:06.97 ISSN 0809-0955).

Sandvika, Norway: Center for European and Asian Studies at the Norwegian School of Management.

American Defense Preparedness Association. (1997, October 26). Luncheon briefing.

Briggs-Myers, I., & McCaulley, M.H. (1985). *Manual: A guide to the development and use of the Myers-Briggs Type Indicator*. Consulting Psychologists Press, Palo Alto, CA.

Pilotless planes: Not cleared for takeoff? (1997, December). *Business Week,* pp.106–111.

Clinton, W. (1997, May). *A national security strategy for a new century.* Washington, DC: The White House.

Cohen, W. S. (1997, May). *Report of the Quadrennial Defense Review.* Washington, DC: Office of the Secretary of Defense.

D'Agostino, D. M. (1996, Fall). Transatlantic cooperative weapons development: How can we better ensure success? *Acquisition Review Quarterly, 3*(2), 131–146.

Dalton, J. H. (1997). *International programs, enhancing global security* (report). Washington, DC: Office of the Secretary of the Navy.

Defense Budget Project. (1995). *Database on International Collaboration in Military Production.* Washington, DC: Author.

Defense Science Board. (1996, August). *International armaments cooperation in an era of coalition security* (report of the Defense Science Board Task Force on International Armaments Cooperation). Washington, DC: Author.

DoD Authorization Act of 1986, Pub. L. No. 99-145, § 1103, 99 Stat. 712, p. 8.

Department of Defense Directive 5000.1. (1996, March 15).

Deputy Under Secretary of Defense (International and Commercial Programs) (DUSD[I&CP]). (1996). *The International Armaments Cooperation Handbook.* Washington, DC: Office of the Secretary of Defense.

Deputy Under Secretary of Defense (International and Commercial Programs) (DUSD [I&CP]). (1997) *The international co-operative research and development program: Achieving superior 21st century defense capabilities.* Washington, DC: Office of the Secretary of Defense.

Farr, C. M. (1985). *An investigation of issues related to success or failure in the management of international cooperative projects.* Unpublished doctoral dissertation, University of

North Carolina, Chapel Hill.

Fisher, R., & Ury, W. (1983). *Getting to yes*. New York: Penguin Books.

General Accounting Office. (1990, October 30). *Internal controls: Funding of international defense R&D projects* (report to the Secretary of Defense/ GAO, GOVDOCS GA1.13 NSIAD 91-27; 10/90 B-237823). Washington, DC: Author.

Harvey, J. B. (1988) *The Abiliene paradox and other meditations on management*. Lexington, MA: Lexington Books.

Jacobs, T. O., & Jacques, E. (1986). Leadership in complex systems. In J. Zeidner (Ed.). *Human Productivity Enhancement: Vol. 2. Organizations, Personnel, and Decision Making* (pp. 7–65). New York: Praeger Publishing.

Jones, D. (1997). In M. Locke & C. A. Yost, *Who needs embassies? How U.S. missions abroad help shape our world*. Washington, DC: The Institute for the Study of Diplomacy, Edmund A. Walsh School of Foreign Service, Georgetown University.

Klisch, J. (1997). Program manager, surface ship torpedo defense. Personal interview.

Kwatnoski, R. (1995, Summer). Cooperative acquisition projects in the Pacific Rim. *Acquisition Review Quarterly, 2*(3), 231–246.

Kwatnoski, R. (1992, September-October). Negotiation of international cooperative defense acquisition agreements: A case study. *Program Manager.*

Mink, O. G., Shultz, J. M., & Mink, B. P. (1979). *Developing and managing open organizations*. Austin, TX: Learning Concepts.

National Defense Industrial Association. (1997, December). U.K./U.S. collaboration deemed 'vital' for future allied military dominance. *National Defense NDIA News,* 43.

Navy International Programs Office (NIPO). (1997, February). Briefing for the Program Review and Coordinating Committee.

Pollock, N. J. (1995). *MBTI and international management* (Management Development Project Report APMC 95-2, M55). Ft. Belvoir, VA: Defense Systems Management College. Unpublished paper.

Pritchett, P. (1993). *High-velocity culture change*. Dallas, TX: Pritchett Publishing.

SAM II (1996, April 26). *Swedish Ameri-*

*can Minesweep II (SAM II) Project History: Appendix D, lessons learned.*

Shalikashvili, J. M. (1997) *Joint Vision 2010.* Washington, DC: Joint Chiefs of Staff.

Shalikashvili, J. M. (1997). *National military strategy of the U.S.A.* Washington, DC: Joint Chiefs of Staff.

Sullivan, A. (1997, December 17). Britain is a natural-born NAFTA nation. http://www.Sunday-times.co.uk/news/pages/sti/97/12/14/stirevopn01003.html?2124396.

Unattributed. (1998, April 14). *Franco-American relations: A study in rancor.* Unpublished study.

# THE IMPACT OF THE PACKARD COMMISSION'S RECOMMENDATIONS ON REDUCING COST OVERRUNS ON DEFENSE ACQUISITION CONTRACTS

***David S. Christensen, Ph.D., Capt David A. Searle, USAF, and Dr. Caisse Vickery***

Using data from selected acquisition reports, Drezner et al. (1993) show that reform initiatives from 1960 to 1990 did not reduce cost growth on 197 defense programs. The average cost growth on these programs was 20 percent and did not change significantly for 30 years. Using data from the Defense Acquisition Executive Summary data base, we show a similar result. Initiatives based on the recommendations of the Packard Commission did not reduce the average cost overrun percent experienced on 269 completed defense acquisition contracts evaluated over an 8-year period (1988 through 1995). In fact, the cost performance experienced on development contracts and on contracts managed by the Air Force worsened significantly. Although many factors contribute to poor cost performance, estimation error is a casual factor identified in each study.

President Ronald Reagan established the Packard Commission in 1986 to reduce inefficiencies in the defense procurement system.[1] Although the commission examined defense management practices in general, it focused on the acquisition process. The commission concluded that the primary problems with the acquisition process were the same ones identified in previous decades (cost growth, schedule delays, performance shortfalls). It recommended streamlining the acquisition process, increasing tests and prototyping, changing the organizational

culture, improving planning, and adopting the competitive firm model where appropriate. Like the problems, the recommendations were strikingly similar to reform efforts of the past and to those of the present (Dews, Giles, Barbour, Harris, and Hesse, 1979; Gates, 1989).

With this research we set out to test the effectiveness of the Packard Commission's recommendations on reducing defense cost overruns. As similar initiatives are identified and implemented today, it is important for policy makers to understand the effectiveness of past policies. Based on a review of 269 completed defense contracts, we found that the Packard Commission's recommendations did not reduce cost overruns. This result is consistent with similar research involving an analysis of cost growth on 197 defense acquisition programs (Drezner, Jarvaise, Hough, & Norton, 1993). Despite the implementation of more than two dozen regulatory and administration initiatives, there has been no substantial improvement in the cost performance of defense programs for more than 30 years.

**"Despite the implementation of more than two dozen regulatory and administration initiatives, there has been no substantial improvement in the cost performance of defense programs for more than 30 years."**

## Literature Review

Unplanned cost increases in defense procurements can escalate to staggering amounts and can adversely affect resource allocation decisions, especially when defense budgets are decreasing. The Department of Defense (DoD) has not ignored this problem. As shown in Table 1, Drezner et al. (1993) identify several important regulatory and administrative initiatives to improve defense cost performance. The expectation was that as these initiatives were implemented, cost performance would improve through time.

Unfortunately, these initiatives did not improve defense cost performance. Using data from the DoD Selected Acquisition Report (SAR), Drezner et al. (1993) computed the average cost growth on 197 acquisition programs with start dates from 1960 through 1990. Results show that cost growth fluctuated around 20 percent, with no substantial improvement through time.

A factor contributing to defense cost growth is estimation error, possibly due to excessive competition.[2] Contractors have an incentive to understate initial costs to win new contracts. Likewise, because programs compete for limited resources, there is an incentive to accept low estimates as reasonable. Drezner et al. (1993) could not test this assertion, but did report that the average initial cost estimates were systematically understated. This finding is consistent with results reported by others (General Accounting Office [GAO], 1988; Tyson, Harmon, & Utech, 1989; McNichols, McFarland, KcKinney, & Balut, 1984; Christensen, 1994, 1996).

There are two weaknesses with Drezner et al. (1993). First, the SAR data base focuses on defense programs. The highly aggregated nature of program data may mask differences that may otherwise be apparent at the contract level. Second, the analysis focuses on cost growth, defined

**Table 1. Acquisition Regulations and Initiatives[1]**

| Year | Regulation or Initiative Published |
|---|---|
| 1969 | Packard Initiatives |
| 1971 | Blue Ribbon Defense Panel (Fitzhugh Commission) |
| 1972 | DoDD 5000.1 (Major System Acquisitions); Commission on Government Procurement |
| 1973 | DoDD 5000.4 (CAIG); DoDD 5000.3 (T&E) |
| 1975 | DoDI 5000.2 (Major System Acquisitions); DoDD 5000.28 (DTC) |
| 1976 | OMB Circular A-109 |
| 1978 | Defense Science Board Acquisition Cycle Task Force |
| 1979 | Defense Resource Management Study |
| 1981 | Carlucci Initiatives; Defense Acquisition Improvement Program |
| 1982 | Nunn-McCurdy (thresholds) |
| 1983 | Grace Commission |
| 1985 | DoD 5000.43 (streamlining) |
| 1986 | Packard Commission |
| 1987 | DoDD 5134.1 (USD(A); DoDD 5000.49 (DAB) |
| 1989 | Defense Management Review |
| 1991 | Revised DoDI 5000.2 (Major System Acquisitions) |
| 1994 | Federal Acquisition Streamlining Act (FASA) |
| 1995 | Federal Acquisition Improvement Act (FASA II) |

[1] Modified from Drezner et al., 1993.

as the difference between the initial budget and the final cost of the program. Cost growth does not distinguish between uncontrollable factors, such as changes in scope or technology, and controllable factors, such as inadequate planning or poor control techniques. For example, Czelusniak and Rodgers (1997) report that Congressional decisions to shift funds to near-term priorities external to a program (e.g., unplanned contingency operations in Bosnia) account for up to one-half of

the cost growth in major weapon systems. Program managers cannot control this kind of cost growth.

Our study attempts to overcome these weaknesses by analyzing cost overruns on completed defense acquisition contracts. A cost overrun, defined as the difference between a contract's final budget and final cost, is a more appropriate metric for measuring the impact of the DoD initiatives because the initiatives focus on actions that program managers can influence, such as thorough planning and disciplined control (McNaughter, 1990). Funding instability and changes in requirements are typically beyond the control of program managers and lead to cost growth, but not necessarily to cost overruns (Christensen and Gordon, 1998). The final budget of a project is a better estimate of what a well-managed contract should cost, because it includes all the authorized changes that may not have been known at the start of a contract.

**"The final budget of a project is a better estimate of what a well-managed contract should cost, because it includes all the authorized changes that may not have been known at the start of a contract."**

Another difference between our study and Drezner et al. (1993) is our focus on the Packard Commission's recommendations. Prior initiatives (e.g., McNamara, Carlucci) had been ineffective in reducing cost growth (Dews et al.; 1979, Gansler, 1989; Drezner et al., 1993), and current initiatives (e.g., the Federal Acquisition Streamlining Act (FASA), the Federal Acquisition Improvement Act) were building on the framework of the Packard Commission initiatives (Gates, 1989).

## Methodology

This study tests whether the recommendations implemented as a result of the Packard Commission affected the cost performance experienced on defense acquisition contracts. The expectation is that cost performance would improve after implementation. To test this hypothesis, we compared the average cost overrun percent on populations of defense contracts before and after the commission's recommendations were implemented using the nonparametric Mann-Whitney test at the 10 percent level of significance.[3]

The hypothesis was tested using cost performance data on 269 contracts, completed between January 1, 1988, and December 31, 1995. The 8-year period provided for approximately four years before and after the treatment date of December 31, 1991. The decision to use four years of performance data before and after the treatment date was subjective, but seemed adequate to account for a gradual implementation of the commission's recommendations.

Based on assessments made by the GAO, we chose December 31, 1991, as the treatment date. In 1990, the GAO reported that efforts to implement the recommendations were in various stages, with some initiatives under way, and others planned for implementation in the "near term" (GAO, 1990). In 1991, the GAO reported that most of the recommended changes had been made and the remaining changes would be completed in the "short term" (GAO, 1991).

The average cost overrun percent (CO%) is defined as

$$CO\% = (\text{Final cost} - \text{Final budget}) / \text{Final budget}) \times 100 \quad (1)$$

$$\text{Average } CO\% = \Sigma (CO\%) / n \quad (2)$$

where the final cost and budget of the contract were the actual cost of work performed (ACWP) and the budget at completion (BAC) reported by the contractor on the last cost performance report, and $n$ is the number of contracts.[4] As a relative measure of cost performance, CO% adjusts for the effects of inflation and contract size.

The monthly cost performance report is prepared by the contractor and submitted to the government throughout the life of the contract. Data from the report are stored in the Defense Acquisition Executive Summary (DAES) data base, maintained by the Office of the Secretary of Defense. At the time of this study, the data base contained cost information from 378

**Table 2. Summary of Contract Data**

| Before Implementation (1988–1991) | | | | | | |
|---|---|---|---|---|---|---|
| | Phase | | | Service | | |
| | All | Development | Production | AF | Navy | Army |
| Number of contracts (n) | 148 | 47 | 101 | 64 | 70 | 14 |
| Average final cost (millions of dollars) | 356 | 312 | 377 | 428 | 328 | 174 |
| Standard deviation | 1105 | 598 | 1276 | 1581 | 544 | 233 |
| Average final budget (millions of dollars) | 341 | 294 | 363 | 412 | 310 | 174 |
| Standard deviation | 1061 | 542 | 1232 | 1524 | 505 | 250 |
| Average final overrun (millions of dollars) | 15 | 17 | 14 | 16 | 17 | 0 |
| Standard deviation | 55 | 59 | 53 | 60 | 55 | 22 |
| **After Implementation (1992–1995)** | | | | | | |
| | Phase | | | Service | | |
| | All | Development | Production | AF | Navy | Army |
| Number of contracts (n) | 121 | 34 | 87 | 49 | 64 | 8 |
| Average final cost (millions of dollars) | 571 | 768 | 494 | 724 | 502 | 190 |
| Standard deviation | 1121 | 2011 | 426 | 1674 | 465 | 117 |
| Average final budget (millions of dollars) | 511 | 647 | 458 | 613 | 476 | 173 |
| Standard deviation | 935 | 1661 | 390 | 1379 | 438 | 114 |
| Average final overrun (millions of dollars) | 60 | 121 | 36 | 111 | 26 | 17 |
| Standard deviation | 274 | 499 | 84 | 421 | 69 | 27 |

defense acquisition programs encompassing 1,843 individual contracts from 1977 through 1995. The reliability of the data is controlled by earned value management control systems criteria,[5] a DoD requirement on most large defense contracts. Virtually all of the data in the DAES data base comes from criteria-compliant contractors. But because of technical problems with the data base and our focus on completed contracts, we could only include 269 contracts in our study.[6]

We also evaluated the sensitivity of our results to contract phase (development, production) and managing Service (Army, Navy, Air Force). Because of greater uncertainties, the cost performance on development contracts is often worse than the cost performance on production contracts (Christensen, 1994). Given the different missions and requirements of the Army, Navy, and Air Force, it is possible that the Packard Commission's recommendations were implemented differently across the Services. Table 2 summarizes the relevant cost data on the contracts used in our study.[7]

## Results

As illustrated in Figure 1, the recommendations of the Packard Commission affected cost performance, but in the wrong direction. Cost performance worsened rather than improved after implementation. As Table 3 shows, the average final overrun percentage for contracts before implementation was 5.6 percent. After implementation, the average final overrun

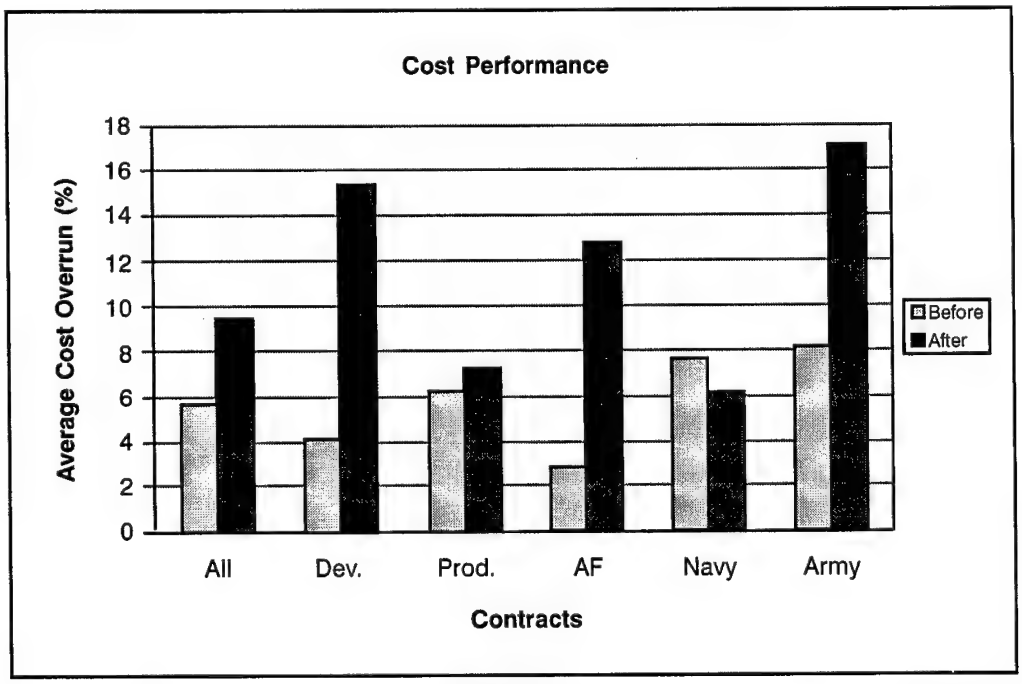



**Figure 1.**
**Cost Performance Before and After Implementing Packard Reforms**

percentage was 9.5 percent. With a $p$-value of 0.055, this change is statistically significant at an a of 0.10.[8]

This result was sensitive to contract phase. The cost performance on the sample of development contacts worsened from 4.1 to 15.3 percent ($p = 0.014$). The cost performance on production contracts also worsened from 6.2 to 7.2 percent, but the change was not significant ($p = 0.294$).

The result was also sensitive to the military service that managed the contract. The average cost overrun on Air Force contracts worsened significantly from 2.8 percent to 12.7 percent ($p = 0.003$). The average cost overruns on Navy and Army contacts did not change significantly. This was true regardless of contract phase.

## Discussion

Overall, these results show that the Packard Commission's recommendations did not improve the cost performance of defense acquisition contracts. As such, the results are consistent with results reported by Drezner et al. (1993). Our study also shows, however, that for development and Air Force contracts, the final cost overrun percentages more than tripled after the recommendations were implemented. In general, development contracts are more risky than production contracts, and appear to be more sensitive to policies affecting cost performance. We do not know why the cost performance of Air Force contracts worsened significantly, while the cost performance of the other Services did not change significantly. Although the Packard Commission's recommendations were to be implemented DoD-wide, it is possible that each Service implemented them differently. Clearly, further research on this issue is needed.

Drezner et al. (1993) also reported strong evidence of understated initial budgets. Based on the same data base used in our study, Christensen (1994, 1996) reported that the predicted final cost on defense acquisition contracts is also systematically understated. Thus, not only are the initial budgets understated, but the revised estimates of final cost are also understated throughout the lives of most defense acquisition contracts. Although

**Table 3.**
**The Effect of Packard Commission Recommendations on Defense Cost Performance**

| | | Contract Phase | | Managing Service | | |
|---|---|---|---|---|---|---|
| | All Contracts | Development Contracts | Production Contracts | Air Force | Navy | Army |
| Number of contracts (n) | 269 | 8 | 188 | 113 | 134 | 22 |
| Final overrun before implementation (%) | 5.6 | 4.1 | 6.2 | 2.8 | 7.6 | 8.1 |
| Final overrun after implementation (%) | 9.5 | 15.3 | 7.2 | 12.7 | 6.1 | 17.0 |
| Difference (%) | 3.9 | 11.2 | 1.0 | 9.9 | -1.5 | 8.9 |
| Statistical significance ( p) | 0.055 | 0.014 | 0.294 | 0.003 | 0.206 | 0.110 |

there are many other causal factors for poor cost performance, it is apparent that prior policies that encourage cost realism have been ineffective.

This study raises some concerns regarding the appropriateness of current reform initiatives. Presently, the DoD is operating in an era of acquisition reform. The passing of the FASA in 1994 and the Federal Acquisition Improvement Act in 1995 marked the first major revisions of acquisition policy since the Packard Commission's recommendations. A review of these policies indicates striking similarities between their major provisions and those of earlier reform efforts, including the Packard Commission (Gates, 1989). Themes such as streamlining, decentralization of authority, empowerment, and cultural change simply re-emerge in a newly packaged policy. Because the current provisions are so similar to prior reform efforts that were ineffective, the DoD should not realistically expect improvements in cost performance.

## Conclusion

The recommendations of the Packard Commission have been ineffective in reducing cost overruns on major defense acquisition contracts. Cost performance on development and Air Force contracts actually worse after implementation of the commission's recommendations. Estimation error was identified as one contributing factor, but additional causal factors are possible. We recommend that the impact of more recent policy changes be investigated. The FASA of 1994 and the Federal Acquisition Improvement Act of 1995 are the first major rewrites of government procurement regulations in a decade. Of course, it will take several years before the cost impact of these initiatives is known. In the meantime, a comparison of new policies with prior reform efforts should yield insight into their likely effectiveness.

**David S. Christensen** is an associate professor of accounting at Southern Utah University. He taught at the Air Force Institute of Technology from 1987 to 1997. In 1994 he retired from the Air Force as a major. With research and consulting interests in defense cost management, he has published more than 50 papers in academic and professional journals, including previously in the *Acquisition Review Quarterly.*

(E-mail address: Christensend@suu.edu)

**Capt David A. Searle,** U.S. Air Force, is presently serving as a contracting officer at the Space and Missile Center at Los Angeles Air Force Base, CA. This paper is a summary of his master's thesis, which he completed in September 1997, at the Air Force Institute of Technology.

(E-mail address: David.searle@losangeles.af.mil)

**Caisse Vickery, Ph.D.,** was an assistant professor of contract management at the Air Force Institute of Technology at the time of this research. Presently, he is the director of the Acquisition Center for Excellence at the National Reconnaissance Office. His research interests include acquisition reform, foreign military sales, and the use of information technology in contracting and purchasing.

(E-mail: Caiselinda@juno.com)

## References


Christensen, D. S. (1996, Spring). Project advocacy and the estimate at completion problem. *Journal of Cost Analysis,* 35–60.

Christensen, D. S. (1994, Winter). Cost overrun optimism—Fact or fiction?" *Acquisition Review Quarterly I,* 25–38.

Christensen, D. S. & Gordon, J. (1998, September). Does a rubber baseline guarantee cost overruns on defense acquisition contracts? *Project Manager Journal.*

Conover, W. J. (1980). *Practical nonparametric statistics* (2nd ed). New York: John Wiley & Sons.

Czelusnniak, D. P. & Rodgers, P. D. (1997, September-October). The Kaminski initiative. *Program Manager 24,* 59–65.

Dews, E., Giles, K. S., Barbour, A., Harris, E.& Hesse, M. (1979, October). *Acquisition policy effectiveness: Department of Defense experience in the 1970s* (R-2516-DRE). Santa Monica, CA: RAND Corporation.

Drezner, J. A., Jarvaise, J., Hess, R., Hough, P., & Norton, D. (1993). *An analysis of weapon system cost growth* (MR-291-AF). Santa Monica, CA: RAND Corporation.

Gansler, J. S. 1989. *Affording defense.* Boston: MIT Press.

Gates, W. (1989, January) *Department of Defense procurement policy reform: An evolutionary perspective* (NPS-54-89-01). Master's thesis. Monterey, CA: Naval Postgraduate School.

GAO. (1988, November). *Weapons cost: Analysis of major weapon systems cost and quantity changes* (GAO/NSIAD-89-32FS). Washington, DC: Government Printing Office.

GAO. (1990, December). *Acquisition reform: Defense management report savings initiatives* (NSIAD-91-11). Washington, DC: Government Printing Office.

GAO. (1991, August). *Acquisition reform: Implementing defense management review initiatives* (NSIAD-91-269). Washington, DC: Government Printing Office.

McNaughter, T. L. (1990). *Defense management reform: For better or worse?* Washington, DC: The Brookings Institute.

McNichols, G. R., McFarland, J. P., McKinney, B. J. & Balut, S. J. (1984, April 30). *The problem of cost growth (analysis of weapon system costs as of December 1983).* McLean, VA: Management Consulting and Research, Inc.

Scott, E. L. (1983, Winter). The cost growth phenomenon. *National Contract Management Journal,* 37–45.

Searle, D. A. 1991. *The impact of the Packard Commission's recommendations on reducing cost overruns in major defense acquisition programs.* Master's thesis. Wright-Patterson Air Force Base, OH: The Air Force Institute of Technology.

Tyson, K. W., Harmon, B. R. & Utech, D. M. (1994, July). *Understanding cost and schedule growth in acquisition programs.* Alexandria, VA: Institute for Defense Analysis.

Weida, W. J. & Gertcher, F. L. (1987). *The political economy of national defense.* Boulder, CO: Westview Press.

## ENDNOTES

1. The commission's formal name was the "President's Blue Ribbon Commission on Defense Management." David Packard was its chairman.

2. Of course, estimation error is not the only factor contributing to unplanned cost. Other factors often cited in the literature include schedule slips, changes in requirements, improvements, management inefficiencies, and organizational culture (Scott, 1983).

3. The parametric t-test failed the key assumptions of normality and equal variances. For a description of the Mann-Whitney test, see Conover (1980).

4. To simply the technical jargon, we prefer the term "cost overrun" to "adverse cost variance." An adverse cost variance occurs when ACWP exceeds the flexible budget, termed the "budgeted cost of work performed" (BCWP).

5. EMVS criteria were formerly termed "cost/schedule control systems criteria" (C/SCSC). In 1996, the criteria were slightly revised and renamed. Despite the multiple names, the criteria have not changed significantly since their inception in 1967.

6. A contract was included in our analysis if it was completed within the 8-year period, and the necessary data were available (contract phase, ACWP, BCWP, and BAC). The DAES data base that we used did not include classified programs. See Searle (1997) for a complete listing of the data used in this study.

7. This study has limitations that threaten its internal validity. In particular, political, macro-economic, and technological events may have occurred during the 8 year-period that may have influenced contract performance. We made no attempt to control for such events. In addition, our sample was not evenly distributed across the Services, with only 8 percent of the contracts managed by the Army. It is possible that the uneven distribution may have biased our results.

8. All hypothesis tests in this study were directional or one-sided.

# THE IMPACT OF THE BUY AMERICAN ACT ON PROGRAM MANAGERS

*Lt Col Joseph S. Smyth, USAF*

The Buy American Act adds another layer of complexity to the program manager's job, especially in the context of the acquisition reform era. Reviewing the background and implementation of the Act will give both industry and government managers guidance on how to proceed under its restrictions.

The Buy American Act has been a staple of federal acquisition since its codification on March 3, 1933. Its express purpose is to provide a preferential treatment for domestic sources of unmanufactured articles, manufactured goods, and construction materials. The Act is of concern to the program manager because of its complicated nature, the requirement for certification of compliance by defense contractors, and its continued existence in an era of acquisition reform.

This article provides a brief background and analysis of the Act, discusses its use as a protectionist policy tool, and considers the impact of acquisition reform. The paper will then discuss the limits on actions for defense managers by reviewing the implementation of the Act in the Federal Acquisition Regulations (FARs) and Defense Federal Acquisition Regulations (DFARs), and provide some guidance for both government and industry defense managers.

## Background and Analysis

The Buy American Act (1933) superseded an earlier 1875 statute that "related to preferential treatment of American material in contracts for public improvements" (1933, Sect. 10). The Act is a complicated, somewhat contradictory law that requires careful reading. It begins with a strong requirement for acquiring only American materials for public use (Sect. 10a), and using only American materials for construction of public works (Sect. 10b). Here is an excerpt from Section 10a (emphasis added):

Notwithstanding any other provision of law, *and unless the head of the Federal agency concerned shall determine it to be inconsistent with the public interest, or the cost to be unreasonable,* only such unmanufactured articles, materials, and supplies as have been mined or produced in the United States, and only such manufactured articles, materials, and supplies as have been manufactured in the United States substantially all from articles, materials, or supplies mined, produced, or manufactured, as the case may be, in the United States, shall be acquired for public use. *This section shall not apply* with respect to...*for use outside the United States,* or *if...are not mined, produced, or manufactured...in the United States in sufficient and reasonably available commercial quantities and of a satisfactory quality. This section shall not apply to ...under any contract...less than or equal to the micro-purchase threshold...*

This excerpt is the original 1933 Act, modified twice since its inception. In 1988, the phrase "federal agency" replaced the phrase "department or independent establishment." The second modification came as a result of the Federal Acquisition Streamlining Act (FASA) of 1994, which inserted the last provision regarding the exemption of the Act from applying to micro-purchases (purchases that are $2500 or less). The Act continues with a series of clarifications and exemptions, detailed below.

**10b-1. Prohibition on procurement contracts; exemptions.** This section adds the requirement that federal agencies not award contracts for articles, materials, or supplies mined, produced, or manufactured in a foreign country whose government maintains, in government procurements, a significant and persistent pattern of discrimination against U.S. products or services. However, the President or head of a federal agency can authorize a contract award if they determine such action is necessary and Congress is notified. In the case of the Department of Defense (DoD) and contracts subject to memorandums of agreement (MoAs) with a foreign country, only the President or his delegate (the Secretary of Defense or service secretaries) can make the determination of necessity. This section also describes what constitutes foreign control of a contractor.

**10b-2. Limitation on authority to waive Buy American Act requirement.** This section allows the Secretary of Defense to rescind blanket waiver of the Buy American Act if a foreign country discriminates against U.S. defense products covered under existing reciprocal agreements.

**10d. Clarification of Congressional intent regarding sections 10a and 10b(a).** This section clarifies (and repeats) the requirement to purchase American made goods and materials "in sufficient and reasonably available commercial quantities and of a satisfactory quality" unless the head of a federal agency determines that it is not in the public interest or the cost is unreasonable.

The annotated version of Section 10 concludes with an excerpt from Executive Order No. 10582 (1954). This order defines

materials as "of foreign origin' if the cost of the foreign products used in such materials constitutes 50 percent or more of the cost of all products used in the materials.

This order also quantifies the term "unreasonable costs" as a domestic bid or offered price that exceeds the bid or offered price of materials of foreign origin by a set price differential. This differential is 6 percent when the foreign bid includes applicable U.S. duty and costs incurred after arrival in the United States, or 10 percent if applicable duty and all costs incurred after arrival in the United States are excluded from the offered price.

## The Act as a Protectionist Policy Tool

Arguably, the Act remains a Depression-era reminder of the protectionist policies of the United States prior to World War II and has had a deleterious effect on the DoD's ability to forge multilateral development projects. The Act was cited under several challenges against federal procurement decisions in the 1980s. These challenges coincided with the recession of the mid-eighties, the rise of an anti-Japanese import sentiment, and several rhetorical calls for protectionism in the media and Congress.

European members of the North Atlantic Treaty Organization (NATO) were particularly vocal in 1982 when the Reagan administration failed to oppose amendments to the defense appropriation bill, which eliminated waiving of Buy American legislation for NATO military programs while still maintaining preferences for Canadian products ("Buy American Actions Concern Allies," 1982).

In 1982, a bill circulated in the House of Representatives to require auto makers that sell in the United States to use minimum percentages of American parts. Although defeated, the bill attempted to halt a trend of American auto makers buying parts abroad and force foreign car companies to build more plants in the United States or cut their exports to the United States. By 1986, cars sold here would have to contain up to 90 percent domestic content (Malone, 1982).

In 1984, the anthracite coal industry, supported by Rep. Joseph M. McDade of Pennsylvania, was responsible for legislation that forced the Pentagon to buy American coal to heat U.S. military bases in Europe, costing the federal government about $15 million a year. The chief lobbyist, Michael Clark, was honest regarding his intentions (Isikoff, 1984):

> "It's a support for the industry, for sure," said Clark, another native of Pennsylvania's anthracite region. But he added that here are many other so-called Buy American provisions passed by the Congress that, in terms of cost to the government, "make us seem like a little squeak in the night, if you know what I mean." "I don't like being pictured as the only U.S. industry being protected by legislation."

This invocation of Buy American is particularly interesting, since the law itself states that the provisions do not apply to material meant for overseas consumption.

The National Council for Industrial Defense filed suit in 1988 alleging that "the Pentagon routinely violates the Buy

American Act and other federal regulations that require the military to make a concerted effort to purchase U.S.-made goods and services" (Pullen, 1988).

In 1987 and 1988, the bearing industry was singled out for protection from foreign competition when a Pentagon working group recommended that DoD and its contractors initiate Buy American regulations for all defense bearings purchases for at least three years (Sfiligoj, 1987). Unfortunately, the industry objected that the proposed recommendations still provided only limited gains in their battle against imports (Fusaro, 1988).

**"Given the strength of the American economy during this period, it seems safe to conclude that the Buy American Act is invoked by industry when protectionist feelings run high and the economy is weak."**

Curiously, there have been few references in the literature in the 1990s. Given the strength of the American economy during this period, it seems safe to conclude that the Buy American Act is invoked by industry when protectionist feelings run high and the economy is weak.

## The Buy American Act and Acquisition Reform

As the acquisition reforms became invigorated by the Secretary of Defense in 1993, several aspects of "business as usual" came under question. These included over-reliance on complicated military specifications, government-industry mistrust, and the more egregious aspects of the FARs. One positive outcome of this reform was the FASA of 1994, mentioned earlier. FASA legislation grew out of a panel study, known as the Section 800 panel, to recommend changes to the acquisition system and recommend any legislative changes. Regarding the Buy American Act, they said:

> The Panel recommends that the rule of origin for Buy American purposes be amended from a "50 percent components test" to a test of "substantial transformation" and that Congressionally imposed domestic source restrictions be repealed.

Their reasoning was cogent (Pilot Program, 1998):

> Commercial sellers should be able to utilize their established facilities, technology, supplier networks, processes, employees and other standard commercial practices in performing Government contracts. The reality that global markets exist and that global markets can be responsive to mobilization needs must be recognized. Waiver is not always possible under current regulations. It is to our strategic and economic advantage to maintain vital foreign sources during peacetime as well as domestic sources or at least have the option to do so when market conditions and the international situation so dictates.

Just prior to the final FASA legislation passage in 1994, there was still doubt that the Buy American Act would be repealed in the final bill. In an article in *Government Executive* (Gregory, April 1994), the Act was targeted as a future area for reform:

> Both DoD and industry groups also want authority for waivers from the Buy American Act, a statute that's increasingly difficult to implement given the multinational origins of many complex products. But [Colleen] Preston [Deputy Under Secretary for Acquisition Reform] predicts that Congress won't approve such waivers in this year's legislation...Preston says DoD may yet seek relief from the socioeconomic requirements. "Our going-in premise," she says, "is that we don't know what specific law it is that breaks the camel's back or inhibits a company from doing business with the government."

Ultimately, FASA failed to implement all the Section 800 panel's recommendations with respect to the Buy American Act, but did modify the Act to allow micropurchases to be excluded as mentioned earlier. Still, some industry officials were cynical about the scope of acquisition reform and the impact of FASA (Gregory, June 1994).

> Government acquisition managers get some streamlining, concedes Peter C. Scrivner of the American Defense Preparedness Association, but the reforms do nothing for industry, he argues. "Acquisition reform? Clearly it is not," he says. Rather, its passage would allow the administration and Congress to check off the action-completed box, whether or not reform was real.

Regardless of initial cynicism, FASA has provided a starting point for acquisition reform. Unfortunately, the momentum of legislative activity has cooled and there appears to be no legislative follow-on to FASA to address future acquisition reform. Five years after FASA, the Buy American Act still remains a prime candidate for future legislative action to streamline acquisition even further.

## Limits on Actions for Defense Managers

The immediate impact of the Buy American Act on defense managers, both industry and government, is to determine whether a proposed acquisition is in compliance with the provisions of the Act. Since certification of compliance with the Act is a standard certification in Section K of the uniform contract format (FAR, 1998, Part 14), it is imperative to understand the implications of the Act. Penalties for contractors who violate the provisions of the Act can include debarment from bidding on contracts (FAR, 1998, Part 9; DFARs, 1998, Part 209). The

**"Regardless of initial cynicism, FASA has provided a starting point for acquisition reform."**

impact on government program managers can include the necessity to issue stop-work orders on contested contracts while contractor protests are adjudicated.

## Implementation in the FARs and DFARs

The Buy American Act is implemented in FAR Part 25 (Foreign Acquisition). Part 25 also includes implementation of the Balance of Payments Program (specifically for acquisitions for use outside the United States), purchases under the Trade Agreements Act of 1979, and other laws and regulations that pertain to acquiring foreign supplies, services, and construction material. FAR Part 25.4 describes the various trade agreements in effect that have bearing on Buy American and the Balance of Payments Program. These are the Trade Agreements Act of 1979 as amended by the Uruguay Round Agreements Act (1994), and other trade agreements including:

**"The implementation of the Buy American Act in the DFARs appears to be much more restrictive than either Title 41 or the FAR 25."**

- countries designated under the Caribbean Basin Economic Recovery Act;
- the United States-Israel Free Trade Area Implementation Act of 1985;
- the North American Free Trade Agreement Implementation Act; and
- the Agreement on Civil Aircraft.

All of these have the effect of exempting a large number of countries (including the European Union) from the effects of Buy American. FAR Part 25.402 lays out the exemption (emphasis added):

> The current threshold is *$190,000 for supply* and services contracts and $7,311,000 for construction contracts...When the value of the proposed acquisition of an eligible product *is estimated to be at or over the dollar threshold,* agencies shall evaluate offers for an eligible product *without regard to the restrictions of the Buy American Act* (see Subpart 25.1) or the Balance of Payments Program (see Subpart 25.3).

FAR Part 25.403 also allows exemptions for "Purchases of arms, ammunition or war materials, or purchases indispensable for national security or for national defense purposes, by the Department of Defense, as provided in departmental regulations." This implements the Title 41, Section 10b-1 (c) authority of the President or federal agency head to authorize contracts that would otherwise be restricted under the Act.

The implementation of the Buy American Act in the DFARs appears to be much more restrictive than either Title 41 or the FAR 25. The "unreasonable price" differential of 6 percent that appears in Executive Order 10582 and FAR 25.105 jumps to 50 percent in DFAR 225.105. There appears to be no basis in statute or FAR for this large jump and its existence severely inhibits a program manager's

ability to choose from a globally competitive market for defense goods. However, there are waivers in the DFARs for the Buy American Act in the interests of national defense. DFAR 225.872-1 lays out these exemptions (emphasis added):

> As a result of memoranda of understanding and other international agreements, the *DoD has determined it inconsistent with the public interest to apply restrictions of the Buy American Act/* Balance of Payments Program to the acquisition of defense equipment which is mined, produced, or manufactured in any of the following countries (referred to in this part as "qualifying countries")
>
> - Australia, Belgium, Canada, Denmark, Egypt, Federal Republic of Germany, France, Greece, Israel, Italy, Luxembourg, Netherlands, Norway, Portugal, Spain, Turkey, United Kingdom.
>
> Individual acquisitions for products of the following qualifying countries may, on a purchase-by-purchase basis, be exempted from application of the Buy American Act and Balance of Payments Program as inconsistent with the public interest
>
> - Austria, Finland, Sweden, Switzerland.

If a waiver is contemplated, DFAR 225.872-4 lays out the requirement to submit a Justification and Approval. Since this must go to the Head of Agency for any procurements of more than $2 million, this is a potential source of delay for awarding contracts to foreign sources.

## Consequences of Failures to Consider the Act

The failure to consider the Buy American Act may be grounds for protest of a contract award to a foreign source by domestic sources that are unsuccessful. Fortunately, protests of contract awards that cite the Act have been denied when there is clear evidence that the acquisition was within the bounds of the FARs and DFARs. In one case, a U.S. firm, Fire-Tec, protested the award of a contract for 15 fire-fighting trucks to any foreign firm, alleging that foreign firms have a competitive advantage over domestic firms because they are not subject to laws and regulations with which domestic firms must comply. The protest was denied, with the following rationale (Defense Acquisition University, 1996):

**"The failure to consider the Buy American Act may be grounds for protest of a contract award to a foreign source by domestic sources that are unsuccessful."**

> In denying the protest, we pointed out that the possession of some economic advantage such as the inapplicability of minimum wage standards provides no basis for rejecting a foreign bid. Reflected

> in our decision was the fact that there is no federal law which seeks to equalize the "competitive advantage" which a foreign firm may possess, other than the Buy American Act, 41 U.S.C. 10a-d (1976). If, after the requirements of the Buy American Act have been satisfied, the foreign bidder remains low, is found to be responsible, and its bid is responsive, then there is no further barrier to an award to that firm.

Even though a contract award may not have been protested, the Act can still have an impact when there are egregious examples of a contracting agency's failure to consider its application. When Rep. James Traficant of Ohio discovered that Chinese-made boots were purchased by the Air Force Reserve Facility in Vienna, OH, the Defense Logistics Agency (DLA) and the Air Force conducted an extensive investigation. DLA and the Air Force found that Chinese-made boots were, in fact, purchased and issued to U.S. military personnel, and that the Buy American Act was violated (http://www.house.gov/traficant/june19.htm, 1997). This prompted an amendment to the fiscal year 1998 Defense Authorization Bill, directing the Inspector General of the Department of Defense to conduct a random audit of U.S. military installations to determine the extent to which base funds are being used to purchase foreign-made goods. Thus, the Act still provides a political mechanism to question DoD acquisition of foreign goods and remains a fixture in acquisition management, for better or worse.

**"The Buy American Act and its subsequent modifications represent one of the most visible and egregious remnants of U.S. protectionism."**

## CONCLUSIONS

The Buy American Act and its subsequent modifications represent one of the most visible and egregious remnants of U.S. protectionism. Its very existence refutes the U.S. desire to only "level the playing field" in international trade. It has been used in the past to justify congressional protection of specific industries with an associated burden to DoD. It has been cited as a justification for other countries to institute their own domestic content requirements.

The Act is implemented haphazardly in the acquisition regulations, where the FARs declare that domestic product prices are "unreasonable" if they exceed foreign product prices by more than 6 percent, while the DFARs use a 50 percent price differential. Acquisition reform groups have targeted its existence for repeal, but efforts to date have failed.

The irony is that the Act is largely ineffective in providing preferences for U.S. domestic content. The Act has numerous loopholes and waiver authority provisions to allow foreign goods to compete with U.S. goods on a reasonably competitive basis. In addition, U.S. defense industries have become very efficient and compete successfully with foreign firms on price and performance of military goods. Therefore, the Buy American Act should make defense

managers wary, but not discouraged, when pursuing foreign-made goods or teaming arrangements with foreign sources to fulfill U.S. military requirements.

**Lieutenant Colonel Joseph Smyth** earned his Bachelor Degree in Electrical Engineering from Tulane University in 1980. As a 1981 Distinguished AFIT Graduate, he received a Masters Degree in Electrical Engineering. He graduated from Flight Test Engineering at the USAF Test Pilot School in 1986, and the Air Command and Staff College in Montgomery, AL, in 1995. As a Guidance and Control System Engineer at the Armament Division, Eglin AFB, FL in 1982, he performed extensive weapon simulations and analyses of all major weapon systems under development, including AMRAAM and GBU-24 LLLGB. In 1986 he became Flight Test Engineer, then Chief Engineer for the F-117 Stealth Fighter, performing weapons, avionics, aircraft performance and flying qualities testing, as well as testing the laser-guided GBU-27 on the F-117. In 1991, as Assistant Deputy for Engineering for Joint STARS Joint Test Force in Melbourne, FL, he integrated it into theater-level exercises (Operations CROSSBOLT and DESERT CAPTURE), demonstrating real-time data fusion, location and targeting. He developed the first operational evaluation of Joint STARS while in developmental test, which was subsequently adopted by AFOTEC for developing operational test plans. As Deputy for Engineering, he led the flight test planning and execution of the production E-8C aircraft. In 1995 as Combined Test IPT lead of the Joint Advanced Strike Technology Program (Joint Strike Fighter), he set up the first Combined Test Working Group, incorporated operational test and live fire test activities into the JSF Program, and authored the test portion of the Single Acquisition Management Plan that supported a Milestone I decision. In 1996 as Chief Engineer for the Boeing X-32 prototype aircraft, he was responsible for all technical aspects of the development of one of the two competing prototypes for JSF, and he conducted both the Initial Design Review and the Final Design Review. In July 1998 he reported to ICAF as a student. His next assignment is Deputy Division Chief, Airborne, C2 and Radar Systems, SAF/AQID.

(Email : smythjns@erols.com)

## References


Agreement on Civil Aircraft, 19 U.S.C. § 2513 (1979).

Buy American Act, 41 U.S.C.A. § 10a. *et. seq.* (West 1933).

Buy American actions concern Allies. (1982, March 22). *Aviation Week and Space Technology.*

Caribbean Basin Economic Recovery Act, 19 U.S.C. § 2701 *et. seq.* (1983).

Defense Acquisition University, CON 201 Government Contract Law, Students Deskbook (1996, October). Fort Belvoir, VA: Author.

Defense Federal Acquisition Regulations, DAC 91-13 (1998, March 9).

Exec. Order No. 10582, "Uniform Procedures for Determinations" (December 17, 1954) 19F.R.8723

Federal Acquisition Regulations, FAC 97-04 (1998, April 24).

Fusaro, D. (1988, April 11). U.S. bearing makers see flaws in new Buy-America regulation. *Metalworking News.*

Gregory, W. A. (1994, April). Buyers beware. *Government Executive.*

Gregory, W. A. (1994, June). USA reforms defence procurement...again. *Interavia Business and Technology.*

http://www.house.gov/traficant/june19.htm (1997, June 19).

Isikoff, M. (1984, February 26). Anthracite coal's lobbyist wields surprising clout; Buy-America Rule saves industry, boosts defense department costs. *The Washington Post.*

Malone, J. (1982, December 13). House "Buy America" mood focuses on auto imports. *The Christian Science Monitor.*

North American Free Trade Agreement Implementation Act, Pub. L.103-182, § 107 Stat. 2057 (1993).

Pilot Program Contract Formation and Administration, Defense Acquisition Deskbook, Version 2.3 [software]. (1998, March 31). Fort Belvoir, VA: Defense Acquisition University.

Pullen, R. (1988, April 18). NCID claims DoD favoring foreign firms; suit alleges violations of Buy American Act. *Metalworking News.*

Sfiligoj, M. (1987, February 23). DoD may go Buy America. *Metalworking News.*

Trade Agreements Act, 19 U.S.C. § 2501–2582 (1979).

United States-Israel Free Trade Area Implementation Act, 19 U.S.C. § 2112 note (1985).

Uruguay Round Agreements Act, Pub. L. 103-465 (1994).

# LOGISTICS TEST AND EVALUATION: *AN OVERVIEW*

**Tony Parker**

Subtle flaws in design can have multimillion-dollar effects—and sometimes potentially catastrophic ones. A vigorous logistics test and evaluation process is essential to ferret out these potential problems, and make sure that when fielded a system is supportable, maintainable, safe, survivable, and transportable. An Office of the Secretary of Defense (OSD) study suggests that this is a job we need to do better; here is a guide on how to go about it, illustrated with specific cases that show its value.

Logistics is a primary element in a thorough test and evaluation of new or modified weapons systems. It is critical to the warfighter that we provide an early assessment of the overall support characteristics of the system we are evaluating.

In our evaluations of the system under test (SUT), we need to remain focused on the goal of providing a system that maximizes its operational availability ($A_o$) within the life-cycle cost (LCC) of the program. The system must minimize the amount of time that maintainers expend getting it ready to perform its mission, recovering the system after the mission, and returning it to a mission-ready status again. That is, we must build systems that maximize their $A_o$s or we build a ground target for the enemy.

A key principle of logistics test and evaluation (LT&E) is to ensure that the system under development is able to achieve the readiness objectives for both peacetime and wartime scenarios. This is accomplished through a unified and iterative approach to the management and technical activities that allow support considerations to influence system requirements and the design process. The support requirements and the design must be optimally related to each other in order to maximize the system $A_o$ throughout its life cycle. During the LT&E process, we systematically evaluate each of the logistic support elements and their interrelationship with other elements. Part of this process is to identify system deficiencies, provide enhancement options, and then

evaluate corrections made to the system. This continuous process will help to ensure the system maximizes its $A_o$ when it is fielded.

So what drove us to reexamine the method we used to evaluate the SUT? One impetus was the OSD study that suggested the Services were not systematically evaluating the SUT as well as could be done. While we may have thought we were doing a good job of putting systems out in the field that were reliable and maintainable and able to achieve their $A_o$, the feedback from the field was that we could do much better.

Reliability and maintainability are what really determine $A_o$. Recall the definition of $A_o$:

$$A_o = \frac{MTBM}{MTBM + MDT}$$

where MTBM equals the mean time between maintenance, and MDT equals the maintenance delay time. The formula is based on the assumption that the system is designed with reliability. Reliability is the probability that an item will perform a required function under specified conditions for a specified period of time, or at a given point in time. Maintainability is the probability that an item will be retained in, or restored to, a specified condition within a given period of time. Reliability and maintainability, along with performance, should act as equal partners in the requirements generation process.

**"Reliability and maintainability, along with performance, should act as equal partners in the requirements generation process."**

## Life-Cycle Costs

In a typical acquisition program, the system program office (SPO) has committed more than 80 percent of the LCC before the engineering and manufacturing development test program has begun. The program hasn't written the check, but they have made key decisions on the design of the system and the support characteristics that essentially commit those funds. Based on design and its reliability and maintainability predictions, the SPO will determine of the number of spares of each particular type that will be purchased, what support equipment will be used, and whether new equipment will be procured. These predictions are also used to determine the types of skills needed and the varying skill levels required, and other manpower considerations. During LT&E, we are chartered to validate the contractor's estimates and provide that data to the program office. Under- or over-estimating the reliability and maintainability of the component pieces of the system will cause already limited dollars to be allocated unwisely. Accomplishing LT&E early and continuously throughout the development, test, and evaluation (DT&E) program allows SPO personnel to determine what needs to be adjusted and by how much, to provide the required system support throughout the program's life cycle.

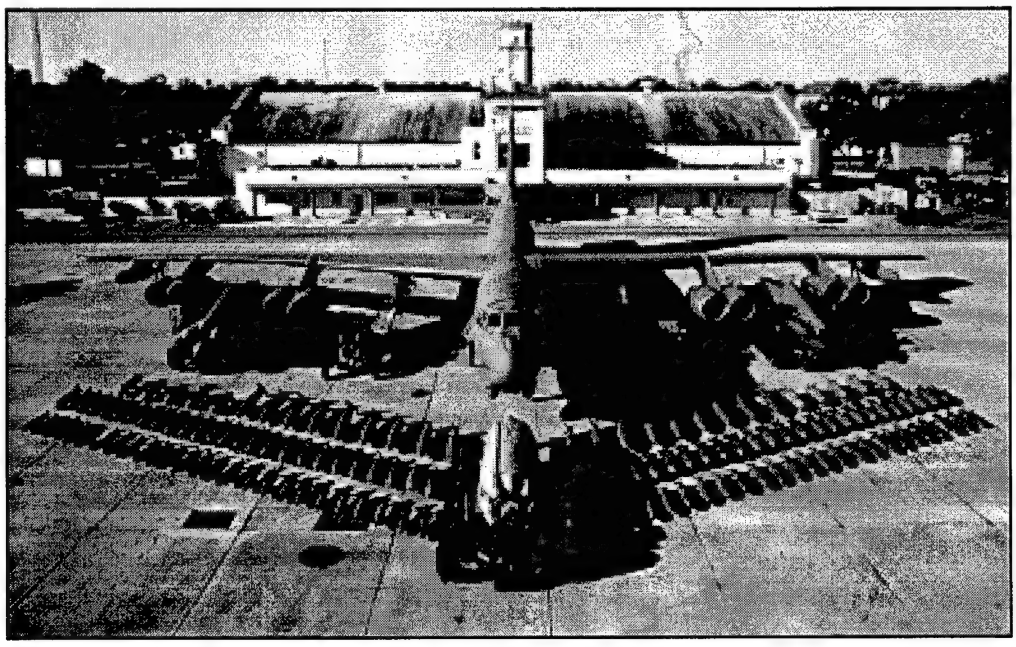
Most of the LCC of a system is spent during the operations and support (O&S) phase. Typically 10 percent of the program's LCC is spent during the research, development, test, and evaluation (RDT&E)

phase of the program. While we may view production as the most costly portion of the program per unit of time, it really only amounts to some 30 percent of the LCC. Based on these figures, it becomes readily apparent that the largest cost driver in the life of a system is the O&S phase. With a system such as the B–52 bomber, which is doubling (or more) its life expectancy, it is easy to see that O&S costs will form 75–90 percent of its LCC. Essentially, it costs almost twice as much to maintain and support a system once it has been fielded as it does to acquire and produce that same system. For a major system such as the B–2, which costs $44 billion in RDT&E and production, the Air Force can expect to spend about $66 billion more in the O&S portion of that aircraft's life cycle.

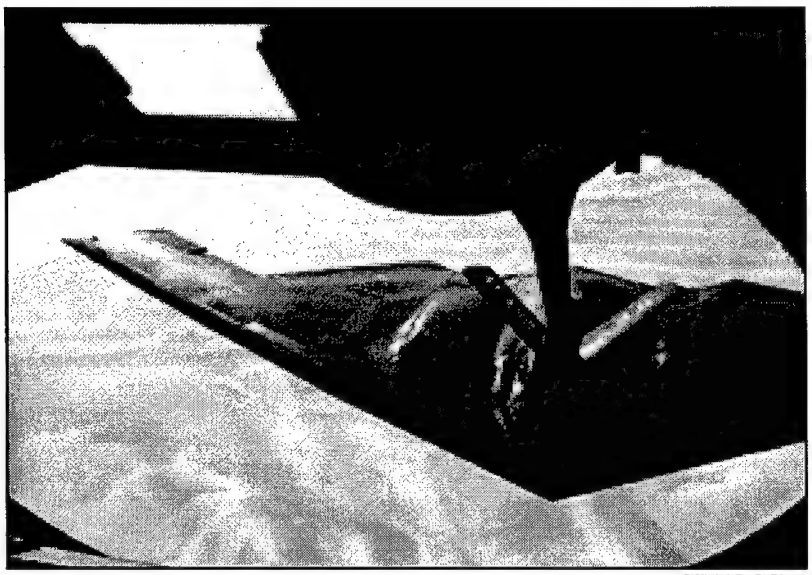
## Coordinating the LT&E Process

The LT&E of today is a significantly different process. Previously we used maintainability demonstrations, support equipment compatibility demonstrations, and technical order verifications, but all were conducted independently. The current LT&E discipline makes a synergistic application of all the logistics support elements. The goal of LT&E is to test, evaluate, analyze the system, and then report those findings to the customer. Established guidance exists that addresses the need to accomplish LT&E. (In fact, when Air Force Instruction [AFI] 99-101 was being drafted, we were asked to develop the wording for LT&E.)

Now that we have guidance, what do we use for test and evaluation criteria? What will define satisfactory systems



**The B–52 Bomber**



**The B-2**

Official DoD Photo

performance? The place to start is the operational requirements document (ORD). What are the requirements the user has given us for the system? How have those requirements been translated into the system specification? For example, what are the mean time between failure (MTBF) and mean time to repair (MTTR) requirements?

Human factor requirements come from both the ORD and the system specification. For example, will we be able to complete all maintenance tasks while in chem gear, or even cold weather gear? Is equipment being designed for ease of accessibility and maintenance? Are line-replaceable units (LRUs) being designed and installed in such a way that one person can accomplish the task if required?

Supportability analysis predictions are a critical part of how we evaluate the system. If the LRU has been designed to work for 350 hours before it fails, then that is the criteria used to evaluate its success or failure. If it fails continually at 100 hours, the customer needs to know, in order to reevaluate system design. If spare LRUs were purchased based on a 350-hour MTBF, there would now be an insufficient quantity of spares.

We need to ensure that, although we test each part of the system, we are able to evaluate the overall system supportability, maintainability, safety, survivability, and transportability. You can almost directly translate these requirements into the logistic support elements (LSEs).

When comparing the test data with the LSE predictions, be aware that a new design or new use of an LRU may suffer infant mortality or have initially low reliability. Test the system long enough to distinguish between development pains and fundamental problems (i.e., the unit not working as it should and the data telling you it's not getting any better). Report these problems to the customer and also provide them with recommended changes to improve the shop replaceable unit (SRU)/LRU, or system. Technical Order

00-35D-54 provides not only a means to report system, LRU, and SRU deficiencies, but a means to recommend enhancements to the system. This is a reason why we use people who have current operational experience to perform the LT&E. They know what is happening in the field and know how to make the system better.

## Finding Problems Early

The AFI 99-101 stressed that the DT&E communities look at the maintainability and suitability (supportability) of the system early in the development program. Although at this point we may be assessing prototypes or preproduction equipment, we can still make an early determination of how the system will work when updated, modified, or changed, based on our DT&E findings. Consider the training that was provided to the maintenance team and make determinations by their ability to maintain the system: Was the training adequate? Are the technical orders they are working with adequate to accomplish the tasks? (They may not be validated and verified.) Is the support equipment they are using the equipment that will be fielded? If not, have they been able to evaluate the proposed support equipment designs? What is the number of personnel needed to support and test the system in the test environment; will this number be adequate for the system when it is fielded? Do we have the correct Air Force Speciality Codes (AFSCs) identified with the correct skill levels? Finally, are the maintenance procedures correct? Are we asking an engine technician to maintain an instrument system, just because it is an engine instrument?

In a typical program it is many years from the development of the ORD to the point at which a system is available for testing in the engineering and manufacturing development phase. During that time, events can change the user requirements: The threat may change, or the program funding may be reduced or increased. The ORD format will identify all of the LSEs and will provide the author the opportunity to input requirements into the ORD for testing those elements to ensure that a supportable system is fielded. The insertion of human factors and LSA predictions is another way to evaluate the data that we gather on the system. These items, the 10 LSEs, the user's requirements, human factors, and the supportability analysis predictions, when tested and evaluated together, provide a comprehensive analysis of whether the system, when fielded, will be able to attain the required $A_o$.

**"Little costs mount up, and eventually impinge upon money that we we need to spend on other new equipment or upgrades."**

Other documents provide additional information. The program office will develop the logistics support plan, which describes how the customer and the acquisition personnel envision life-cycle support for the system. LT&E is the primary method used to test the plan and determine if it is effective. The contractor will also have a plan describing how the system will be supported from production to disposal. This plan should be developed using a relational data base, which flags how changes in one element will affect others. (For example, if the numbers and skills of the personnel in the field change,

the data base will identify other support elements that will be affected.)

The test and evaluation master plan (TEMP), written by the test planning working group, is one of the primary management documents for this phase of the program. The TEMP contains five sections:

- a system description;
- an integrated program schedule with a focus on the test schedule;
- DT&E objectives;
- the objectives of the operational testers; and
- the test program resource requirements.

Examples of program resources are: number of personnel required, location of testing, duration of testing, number of test articles, number of spare assets, funding by fiscal year, and training. Program resources are what we, the test community, need to complete the test and evaluation of the system.

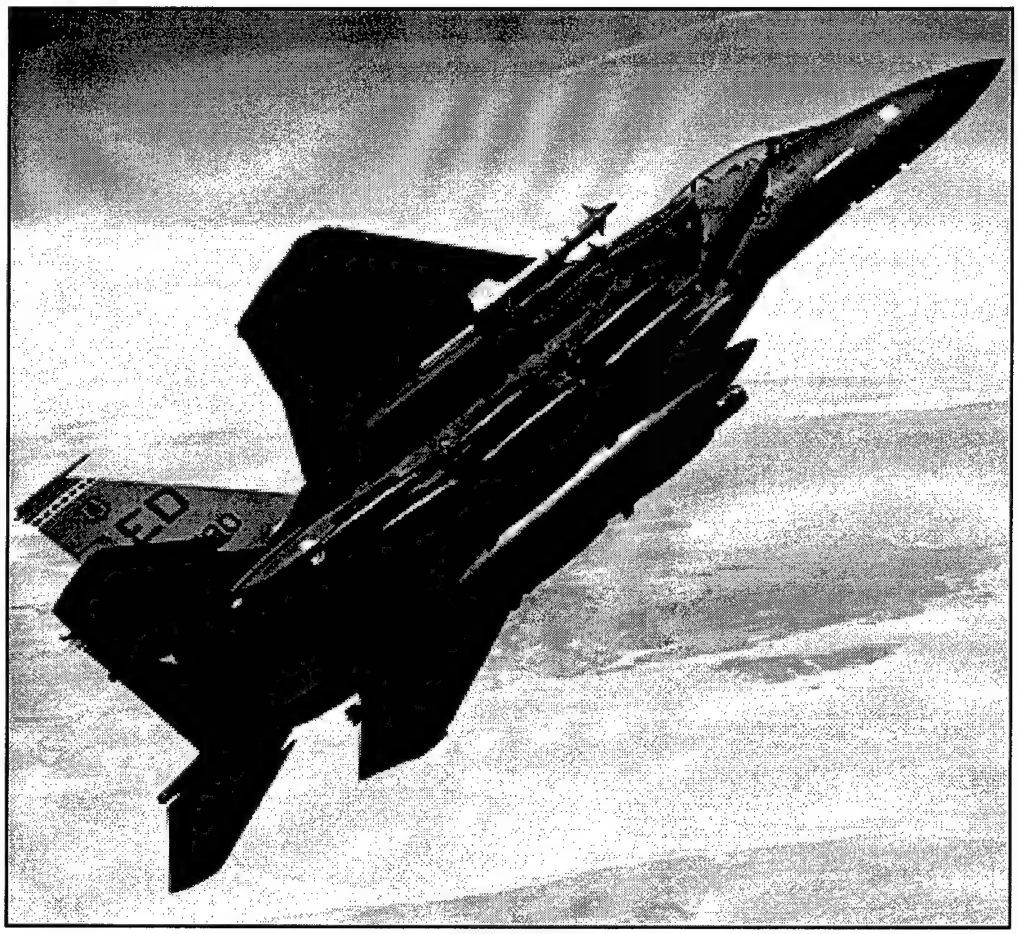
## LT&E Successes

Let's look for a moment at some of the results of accomplishing LT&E. During testing of a new F–15 crypto key loading device, the contractor had recommended a new extension cable. Maintenance personnel determined that it wasn't necessary to use the cable to load the device. This saved $58 per cable and about $1,044.00 per F-15 fighter wing per year. It doesn't seem like much, until you look at a small cost like this in the context of shrinking budgets. How many fighter wings of F–15s do we have, and how long will the F–15 remain in the inventory? Little costs mount up, and eventually impinge upon money that we we need to spend on other new equipment or upgrades.

The results of successful LT&E can be potentially much more dramatic: In the original global positioning satellite modifications on the F–15, the seal for the controlled reception pattern antenna had metal washers that were not captive in the seal and were prone to slip off the seal during installation and removal. As a result of input from the maintainers, the finished product eliminated the need for the seal and the loose hardware. Another modification of the global positioning satellite recommended by maintenance personnel was the relocation of the proposed antenna electronics unit, which chafed against the right rudder pedal cable. The possible consequences of this initial design flaw—loss of the aircraft and possibly of the crew—demonstrate the value of this kind of assessment.

An example of what can happen if the maintainers are not involved early in the DT&E process is demonstrated by the modified SUU–73/A pylon. When the pylon was installed as designed, certain engine access panels could not be opened. So every time access was required, the fuel tank pylon or the weapons pylon would have to be removed—an 8-manhour job. Needing excess time to repair aircraft is just the same as not having enough aircraft to accomplish the mission.

Here's a good example of how being involved early in the acquisition process has an impact on the design. An electro-environmental specialist looking at the mockup at the plant in Long Beach, CA,



**The F–15**

noticed that the C–17 cargo compartment liquid oxygen filler connection had protruding screws, which would prevent the filler cart hose from being attached properly. When brought to the attention of the manufacturer, the flaw was described as merely an error in the mockup. Through persistence, the specialist found and studied the design drawing, and determined that it was assembled correctly. The connector would not have been able to lock, and maintenance would have been unable to service the system. The drawing was changed and the assembly line was checked to ensure that the change was incorporated.

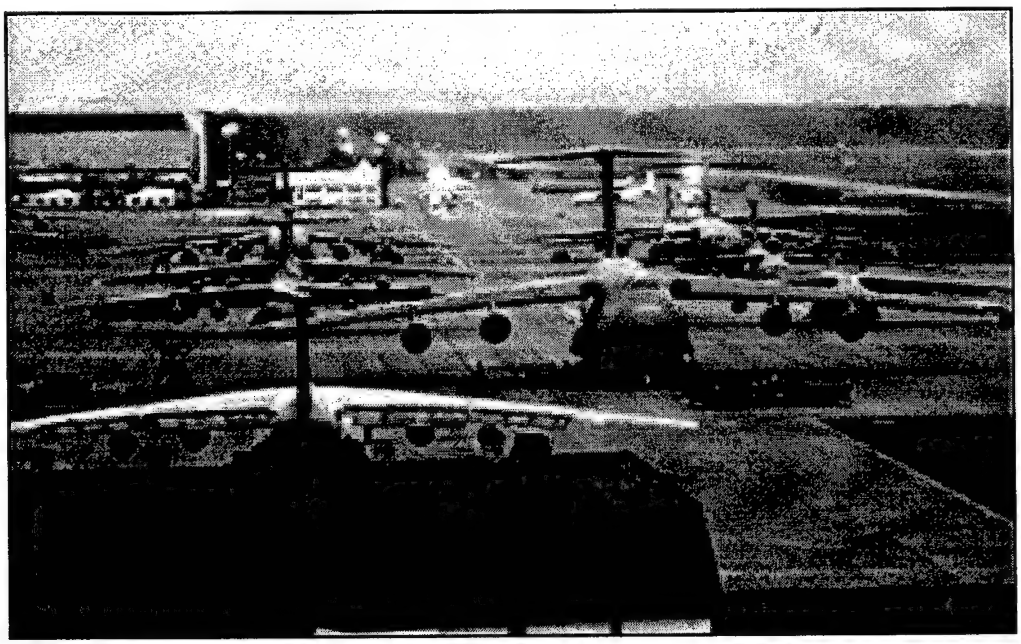
The following example shows how a small item can run into big money because reliability figures weren't accurately estimated. A wingtip lamp for the C–17, both front and rear positions, is the same lamp that is installed in the KC–10 (DC–10) to illuminate the wing's leading edge during flight. On the KC–10 it is mounted in the side of the fuselage skin in a very benign environment, and needs to be replaced every 676 hours. That same lamp on the wingtip of the C–17 is in a different

operating environment (higher vibration and temperatures) and the lamp only lasts for 25 hours in the forward position and 50 hours in the aft position.

The lamp did not come close to its predicted value, and if insufficient spares of this mission-critical part were purchased, all of the C–17s could soon be grounded for want of a lamp. The impact of the lamp's invalid reliability figure of 676 hours MTBF on the life-cycle cost of the C–17 is an estimated additional $4.5 million. With the actual MTBF numbers in hand, the system program office can at least adjust the procurement requirements for spares.

Here is another example of the effectiveness of early LT&E in identifying design shortfalls. The original estimate for the C–17 water coalescer bag was that it would be changed approximately once a year (about every 1,000 to 1,200 flying hours), which was the normal change rate for the current fleet of airlifters (C–130, C–141, C–5). We determined during the test program that because of the design of the auxiliary power unit's intake and exhaust, and the proximity to the air conditioning system intake, the bags (sometimes called the water separator socks) were becoming clogged every 25 flying hours. It didn't take long for supply of bags to run out. Through some redesign and changes in the maintenance procedures, the bags now last about 250 hours (still a dramatic LCC impact). If it doesn't get fixed, the cost will be an estimated $29 million.

Another instance of the value of early design review occurred during the B-2 program, when egress technicians at the manufacturing facility reviewing the mockup design noticed the upper escape hatch was secured with hi-torq fasteners.



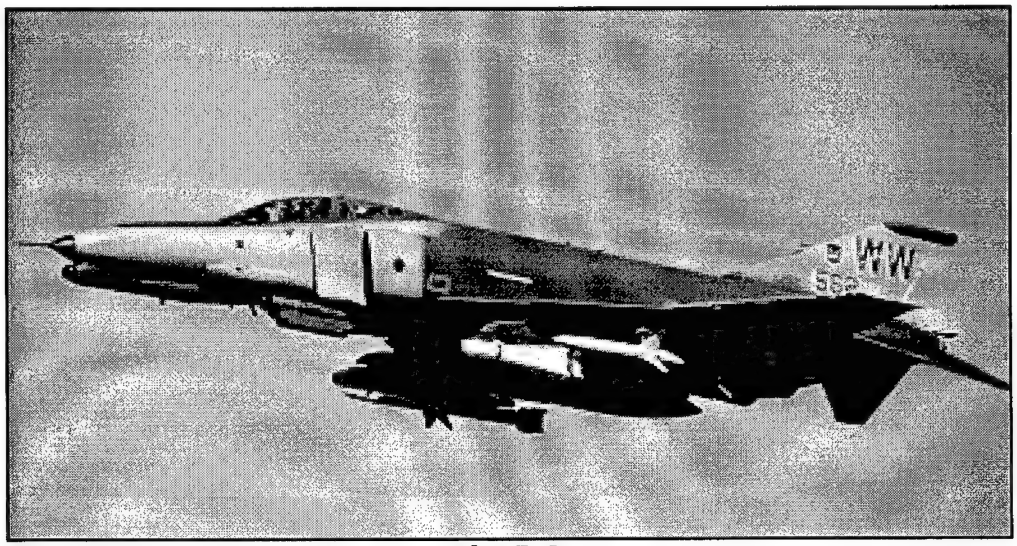
Official DoD Photo

**The C–17**

The upper hatch has to be removed once a year for inspection of the ejection seat. The maintenance demonstrations showed that with the hi-torqs installed, it would take two people 214 manhours to remove the hatch. This amounted to a 5-day effort, working around the clock. The egress technicians wanted to change the hi-torqs for screws and nutplates, but the engineers were reluctant, asserting that the hatch was a stress panel. The egress technicians pointed out that the F–4 aircraft was basically a flying stress panel, and used screws and nutplates predominately throughout the aircraft to secure panels. It was agreed to evaluate the change to screws and nutplates. After a series of successful tests at the Holloman Air Force Base, NM, sled track, it was agreed to use screws and nutplates. The maintenance task time was reduced to 18 manhours (2 people)—in other words, one normal work shift. This seemingly simple change meant the aircraft increased its $A_o$ dramatically. What this means is the inspection can be done overnight and the aircraft will be ready to fly and fight again the next day.

## Conclusion

Logistics test and evaluation is a major portion of the DT&E process. The goal is to field systems that are supportable from the very beginning. That doesn't mean that we won't continue to modify weapons systems. It means that the modifications we install will be the result of new technology, not something that we will constantly have to modify just to meet the original reliability and maintainability goals. We will make sure the user gets what they ask for and that it meets the ORD requirements for $A_o$. If it is supposed to have a 95 percent fully mission capable rate, is that what is occurring in the field? If it is not at 95 percent, why not? Does the radar work for 500 hours before it fails, as it was required to do? If not, why not? Is the user spending all of its O&S money



Courtesy U.S. Air Force

**The F–4**

on modifying the system to make it meet those original requirements, or are they spending it on the things necessary to maintain their proficiency to be prepared in times of crisis?

Ensuring that the warfighter receives maintainable and supportable systems is the goal of LT&E. While it will generally have a larger LCC impact if discovered during the DT&E process. LT&E should continue throughout the operational T&E phase and in fact should be a part of any modifications that will effect the supportability of the system.

**Tony Parker** has been associated with the Air Force in the aircraft maintenance and logistics career field since 1961. After retirement from active duty, he returned to government service as a logistics manager. He is currently employed at the Air Force Flight Test Center's 412th Logistics Group. He is a staff officer in the Logistics Test and Evaluation Office.

E-mail address: anthony.parker@edwards.af.mil

**DISCLAIMER**

The opinions, interpretations, conclusions, and recommendations herein are those of the author and are not necessarily endorsed by the U.S. Air Force.

# VALUE COST MANAGEMENT REPORT TO EVALUATE THE CONTRACTOR'S ESTIMATE AT COMPLETION

***David S. Christensen, Ph.D.***

The earned value cost management report is a valuable management tool for project managers. Its long association with earned value management systems criteria (formerly cost/schedule control systems criteria) and the related technical jargon, however, may have caused some project managers to ignore the information that it can provide about the future performance of their projects. This article is a brief tutorial for project managers and others interested in using the report more effectively. Actual performance data from a failed project and important research results are used to describe three simple analysis techniques for evaluating the contractor's projected final cost of a project, termed the estimate at completion.

For more than three decades, the Department of Defense (DoD) has required defense contractors to report detailed information about the cost and schedule status of a defense contract on a monthly cost management report, known as the cost performance report (CPR) or the cost/schedule status report (C/SSR). Earned value, or the budgeted cost of work performed, is a key performance metric on the report.[1] It is the basis for determining cost and schedule variances, and is often used as part of a formula to help estimate the final cost of the contract, termed the estimate at completion (EAC).

To assure the reliability of the CPR, defense contractors were also required to comply with generic management standards known as cost/schedule control systems criteria (C/SCSC). Although the management standards or criteria were sound, policies related to implementing them grew to become an administrative burden for the government and the contractor (Coopers and Lybrand, 1994; General Accounting Office, 1997). In addition, C/SCSC compliance reviews were typically managed by financial personnel and conducted like audits. As a result, the project manager often perceived the CPR

as a financial rather than a management report, and did not use it as effectively as possible (Abba, 1995).

Recently, the implementation polices were revised to foster more cooperation between the government and the contractor and to establish the CPR as a management report. Overall responsibility for earned value management was moved from finance to project management in 1989. In 1996, the criteria were revised by industry, accepted by the government, and re-named earned value management systems (EVMS) criteria.

The basic concept of earned value management has not changed since its inception since 1967. In addition, the content of the cost management report has not changed, possibly because its value as a project management tool is widely recognized (Little, 1983 and 1984; DoD IG Audit Report, 1993; Office of Management and Budget, 1997; GAO, 1997). This article describes the basic data provided in the report and identifies a few techniques for converting the data into information useful to contract managers, project managers, and others involved in managing a major project. In particular, three ways to evaluate the reasonableness of the *contractor's* EAC are described. Two of these involve comparing the project's cumulative cost performance with its predicted future performance. The other technique involves comparing a range of estimates found to be accurate on a large number of completed projects with the predicted final cost of the ongoing project.

**"The effect of a manufacturer's changes to aviation COTS can be boiled down to two specific difficulties, airworthiness and forced modifications."**

Although the example is taken from a large, criteria-consistent defense contract, the basic analysis techniques described in this article apply to projects of any size, government or commercial. Versions of the DoD's EVMS criteria have been used for many years by nondefense agencies, including the Department of Transportation, Department of Energy, and National Aeronautics and Space Administration. In recent years, earned value management systems and the resulting data from those systems have been used to manage commercial projects in the United States and abroad (Abba, 1995).

## The Terminology of Earned Value Management Reports

Terminology used in earned value management reports can be confusing. The acronyms alone number in the dozens. Regardless of the kind of project (defense, space, construction, etc.), however, only three basic data elements listed on the earned value management report are central to proper planning, measurement, and analysis: budgeted cost for work scheduled (BCWS), budgeted cost for work performed (BCWP), and actual cost of work performed (ACWP). Nearly all of the other data items may be derived from them.

The BCWS is the budget for work scheduled to be completed. It can be either monthly or cumulative. As a monthly amount, it represents the amount of work scheduled to be completed for that month. As a cumulative amount, it represents the amount of work scheduled to

be completed to date. BCWS is also known as "planned value."

The BCWP is the budget for the completed work. It also can be either monthly or cumulative. Monthly BCWP represents the amount of work completed during a month; cumulative BCWP represents the amount of work completed to date. BCWP is also known as "earned value."

The ACWP is the actual cost incurred in accomplishing the work within a given period. Like the budgets, both direct and indirect costs are included.[2] To permit meaningful comparisons, the ACWP should be recorded in the same time period as BCWP for a given piece of work.

At the start of a project, work is typically categorized into near-term and far-term effort. The near-term effort is divided into manageable pieces known as work packages. On a large project, there may be more than 100,000 work packages that must be performed before the project is completed. As a result, only the near-term work is planned in detail. The remaining work is known as planning packages. As the project progresses, the planning packages are systematically divided into work packages and planned in detail.

Regardless of the timing of the work, a budget in terms of hours, dollars, or other measurable units is assigned to each work and planning package. By summing their budgets, a time-phased budgetary baseline for the entire project is defined. This baseline, known as the performance measurement baseline (PMB), represents the standard or plan against which the performance (BCWP) and the cost (ACWP) of the project are compared.

Figures 1 and 2 illustrate the typical condition of many projects: behind schedule

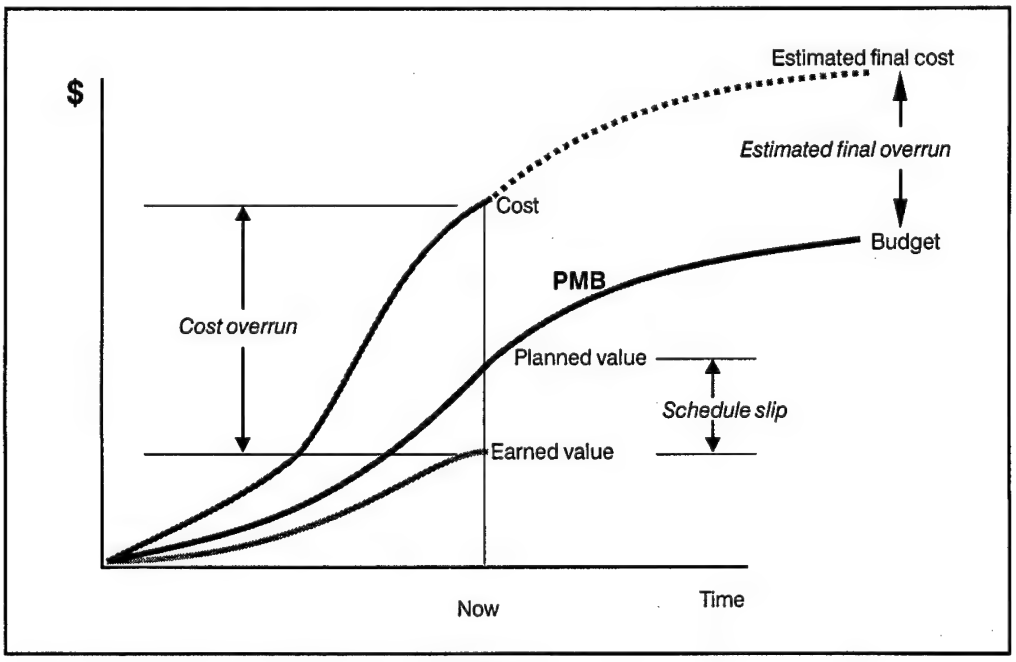



**Figure 1.**
**Performance Measurement Baseline (Without Technical Jargon)**

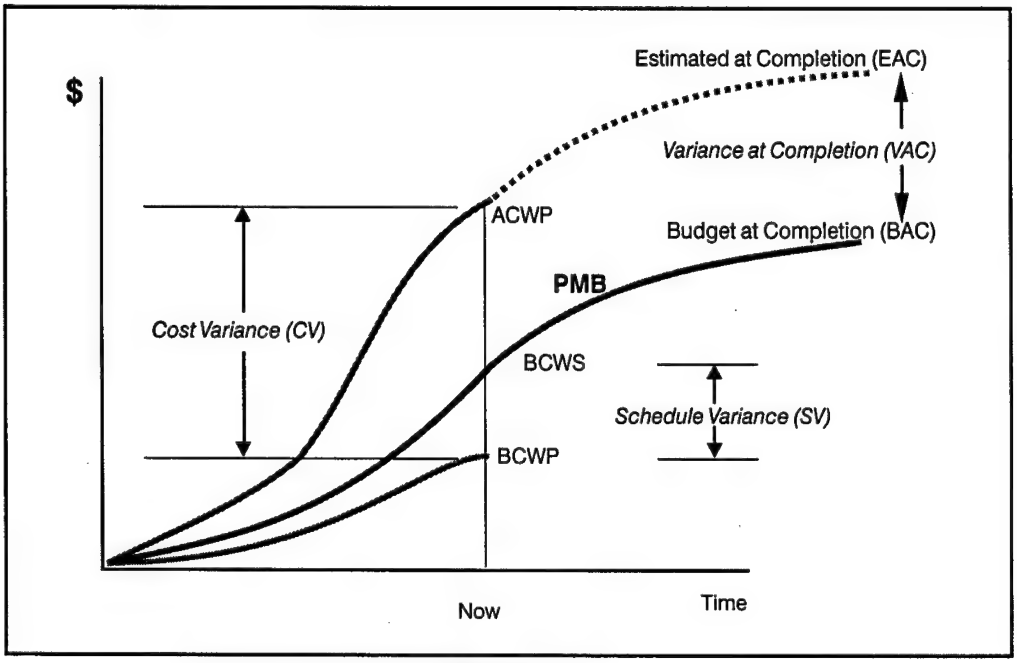



**Figure 2.**
**Performance Measurement Baseline (With Technical Jargon)**

and over budget. Figure 1 uses nontechnical jargon. Figure 2 uses the technical jargon just described. The PMB represents the plan. Because less work has been completed (in terms of dollar value) than was planned to be completed at this point, a schedule slippage (adverse schedule variance) is identified. Similarly, because actual costs exceed the budget for the completed work, an unfavorable cost variance is identified.

The figures also illustrate a third variance. The variance at completion (VAC) is the difference between the total budget of the project, termed the budget at completion (BAC), and the estimated total cost of the project, termed the estimate at completion (EAC). In this case, an adverse VAC (estimated final overrun) is indicated.

When these variances are judged significant they are immediately investigated by managers who are empowered to take appropriate corrective action.[3] The cost management report summarizes the monthly cost and schedule status of the project by listing the three data elements, the related variances, the BAC, and the revised EAC for all of the major pieces of work on the project.

The report also describes the causes of the variances and the corrective action plans related to the variances. Typical causes of variances include poor initial planning or budgeting, changes to the project's scope, changes in technology related to the project, changes to the delivery schedule, changes to labor contracts, changes to material costs, inflation, and measurement error. Inaccurate indirect

cost allocations can also contribute to cost variances reported on defense contracts. The project's PMB includes indirect cost as well as direct cost. In addition, ACWP includes indirect costs, and defense contractors must investigate all significant cost variances, including indirect cost variances. The Defense Contract Audit Agency (DCAA) is usually given the responsibility for ensuring that the contractor's indirect cost management systems are in compliance with the criteria.[4]

Eventually, summarized portions of the cost management report reach the Office of the Secretary of Defense (OSD) and Congress, where they may be used to help determine the continued funding of the project.[5] Only rarely has a large cost overrun on a defense contract resulted in the project's cancellation. However, Congressional oversight, the threat to cancel funding, and the budget discipline required by the criteria may have limited cost growth on defense projects. Although the average cost overrun on defense contracts has averaged about 20 percent since the mid-1960s, cost overruns on some nondefense projects of comparable size and complexity have been larger (Drezner, Jarvaise, Hess, Hugh, and Norton, 1993, p. xiv).

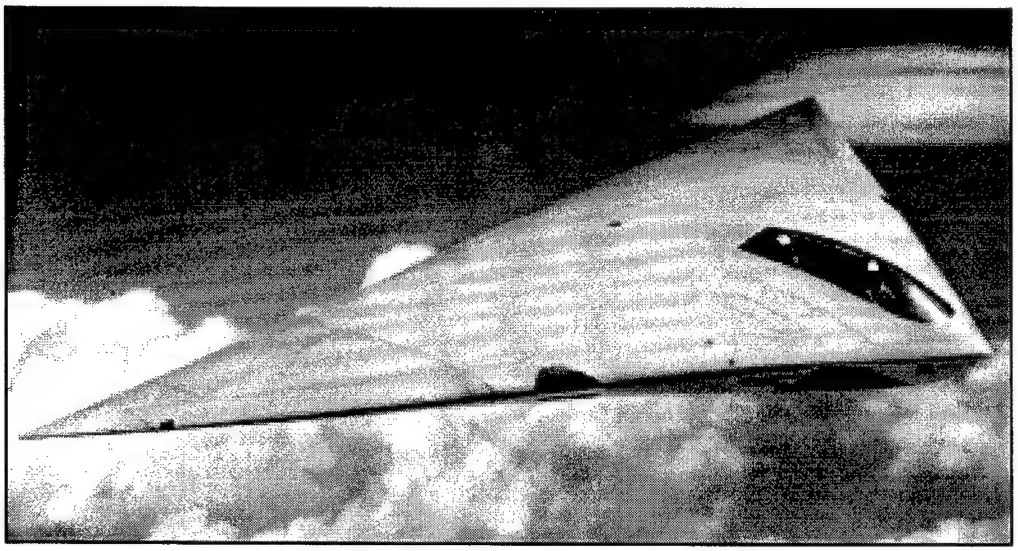
## Evaluating the Contractor's Estimate at Completion

From the contractor's and the government's perspectives, the contractor's EAC is one of the more critical numbers on the cost management report. The contractor is required to advise the government of potential significant overruns or underruns. In some cases the EAC is used to adjust progress payments (DCAA, 1996, paras. 11-207, 14-205). Deficiencies in determining or revising the EAC may significantly affect forward pricing proposals, billing requests, and the reliability of the VAC as a control variance (Dahlberg, Colantuono, and Fischer, 1992, p. 9).

Given its importance, the EAC is periodically revised by the contractor and closely monitored by the government. Contractors periodically develop "comprehensive" EACs by estimating and aggregating the costs of incomplete work and planning packages remaining on the contract.[6] In addition, the contractor's EAC is examined monthly for accuracy and revised as necessary to ensure that resource requirements are realistic and properly phased (DoD, 1996, para. 3-6e). Whenever the EAC is changed, the contractor should explain the rationale in the cost management report that is sent to the government. Frequent revisions of the EAC are not necessarily considered evidence of its unreliability. On a multiyear defense project, an unchanging EAC would be suspicious.

**"Given its importance, the EAC is periodically revised by the contractor and closely monitored by the government."**

Despite the discipline required by the criteria, a RAND study recently concluded that EACs have been systematically understated for more than 20 years (Drezner et al., 1993). Because a systematic bias in the EAC can adversely affect the resource allocation decisions made by Congress and eventually the effectiveness of defense policy, it is important to know how to identify an understated EAC. The



**The A–12**

remainder of this article describes three simple analysis techniques that may be useful in evaluating the accuracy of the contractor's EAC. Cost performance data from the Navy's A–12 program is used to illustrate the techniques.[7]

The A–12 was the Navy's premier aviation project. In January 1991, Secretary of Defense Richard Cheney canceled the project, complaining that no one could tell him what the final cost of the project would be. In fact, there were many EACs, some more credible than others. Unfortunately, the more credible EACs were not reported on the CPR or the summary reports sent to the Office of the Secretary of Defense.[8] A Navy investigation of the A–12 cancellation revealed that adverse information about the A–12 may have been suppressed by the Navy Program Office. The Navy's "inquiry officer" on the cancellation of the A–12 program, C. P. Beach, Jr., concluded that schedule and cost goals for the A–12 were too optimistic and should not have been supported by government managers in the contract and program offices (Beach, 1990, p. 39–41). Table 1 shows the April 1990 cost performance data for the A–12, six months before the project was canceled.

To evaluate the reasonableness of the contractor's EAC, three comparisons should be made. First, the overrun to date (cost variance, CV) should be compared

**Table 1.**
**Cost Performance Data for A–12 Project**
**(April 1990, Millions of Dollars)**

| Month | BCWS | BCWP | ACWP | SV | CV | BAC | EAC | VAC |
|---|---|---|---|---|---|---|---|---|
| April | 2,080 | 1,491 | 1,950 | (589) | (459) | 4,046 | 4,400 | (354) |

to the estimated final overrun (VAC). If the overrun to date is worse than the estimated final overrun, the contractor is predicting a recovery. Thus, in April 1990 the A–12 contractors predicted a recovery of $105 million ($459 million to $354 million). Recoveries from cost overruns on defense contracts are extremely rare, especially when the project is more than 20 percent completed. In this case, the project is about 37 percent complete (BCWPcum/ BAC). Analysts should have been extremely dubious about the ability of the A–12 project to finish at $4.4 million. The report on the A–12 cancellation indicated that the Navy cost analyst who was responsible for analysis of the A–12 CPR briefed higher, more realistic EACs to the Navy Program Office. But the program manager chose to rely on a lower, more optimistic EAC and reported it to higher level decision makers as the "most likely" EAC (Beach, 1990, p. 13).

The second comparison uses two performance indices: the cost performance index (CPI) and the to-complete performance index (TCPI). As Equation 1 shows, the CPI measures the budgeted cost of completed work against the actual cost. If the CPI is less than one, an unfavorable cost variance is indicated. In this case, the CPI is 0.76 (1491 / 1950), which means that for every dollar spent, $0.76 of work has been completed.

$$\text{CPI} = \text{BCWP} / \text{ACWP} \quad (1)$$

As shown in Equation 2, the TCPI measures the budget for the remaining work (BAC-BCWPcum) against the estimated cost to achieve the EAC (EAC – ACWPcum). In this case, the TCPI is 1.04, indicating $1.04 of work to be completed for every dollar spent. Research on completed defense contracts shows that the cumulative CPI does not change by more than 10 percent from its value at the 20 percent completion point, and *in most cases only worsens* (Christensen and Heise, 1993). Thus, when the cumulative CPI is significantly less than the TCPI, it is highly doubtful that the contract will be completed at the EAC. In the A–12 case, this simple comparison indicates that the EAC was too small. More realistic EACs could have been computed using the simple formula shown in Equation 3.

$$\text{TCPI} = (\text{BAC} - \text{BCWPcum}) / (\text{EAC} - \text{ACWPcum}) \quad (2)$$

$$\text{EAC} = \text{ACWPcum} + (\text{BAC} - \text{BCWPcum}) / \text{Performance factor} \quad (3)$$

The final comparison involves generating a range of "independent" EACs using the generic formula shown in Equation 3. Figure 1 illustrates that the EAC can be estimated by extrapolating ACWPcum to the end of the project. More specifically, Equation 3 indicates that ACWPcum is extrapolated by simply adding ACWPcum to the budget for the remaining work (BAC – BCWPcum), adjusted by applying a performance factor. The performance factor may reflect the analyst's expectations about the future performance on the contract. Using data from hundreds of completed defense contracts, researchers have concluded that past performance on defense contracts is predictive of the future (Christensen and Heise, 1993; Drezner et al., 1993).[9] Hence, the performance factor used in Equation 3 is often either the CPI, the schedule performance index (SPI), or some combination of the two indices.

**Table 2.**
**A Range of Estimates at Completion for the A–12**
**(Derived from the Cumulative Performance Data in Table 1)**

| Performance factor | Performance factor value | EAC (Millions) |
|---|---|---|
| CPI x SPI | 0.5481 | $ 6,612 |
| SPI | 0.7168 | $ 5,514 |
| .8 CPI x .2 SPI | 0.7551 | $ 5,334 |
| CPI | 0.7646 | $ 5,292 |

Equation 4 shows the formula for the SPI. An SPI that is less than one indicates an unfavorable schedule variance.[10] In the A–12 case, the SPI is 0.72, indicating that for every dollar of work scheduled to be accomplished, only $0.72 was accomplished. In other words, the contract was behind schedule as well as over budget. Because scheduling problems often require additional funding to correct, an unfavorable SPI may be predictive of future cost overruns (Christensen, Antolini, and McKinney, 1995).

**SPI = BCWP / BCWS (4)**

Table 2 shows four popular performance factors (CPI, SPI, 0.8 CPI + 0.2 SPI, CPI x SPI) and the resulting EACs using the A–12 data.[11] If this range of EACs is considered reasonable, the $4,400 million EAC reported by the contractors is clearly understated. Note that the smallest and largest EACs were derived from the CPI and the product of CPI and SPI, respectively. This is expected. Research has shown that the EAC derived from the CPI is a reasonable floor to the final cost (Christensen, 1996). Also, the EAC based on the product of CPI and SPI is usually quite large because, historically, most defense contracts finish behind schedule and over budget (Christensen, 1994; Drezner et al., 1993). When a contract is behind schedule and over budget, the SPI and the CPI are each less than one. On April 1990, the SPI and CPI of the A–12 were 0.7168 (=1491 / 2080) and 0.7646 (=1491 / 1950), respectively. When these two performance indices are multiplied together, the product is less than either index by itself (0.7168 x 0.7647 = 0.5481), and the resulting EAC is very large.

## Conclusion

The use of earned value is accelerating worldwide. Although it began in industry, it was developed and used primarily on U.S. defense contracts. The association with the DoD's cost/schedule control systems criteria may have created a misconception that earned value is inappropriate for smaller, nongovernment projects. But earned value and the related

cost management reports can be used without the criteria on projects of any size. On large government projects, where the risk of cost growth is often carried by the government, the planning and control discipline fostered by the criteria is essential. On other kinds of projects, a full-scale application of the criteria is not necessary (Fleming and Koppelman, 1996). As a result, other U.S. government agencies, governments of other countries, and companies across the world have accepted earned value as an effective project management tool (Abba, 1995, 1997).

The simple analysis methods described here illustrate one beneficial use of earned value data: evaluating the reasonableness of the contractor's EAC. Although the acronyms and technical jargon used in project management can be confusing, the cost management report prepared from earned value data can provide project managers with valuable insight into the cost and schedule status of their project. When used properly, the variances and performance indices can help a manager focus attention on emerging problems. The cost management report is not a financial report. It's a tool for project managers.

**David S. Christensen** is an associate professor of accounting at Southern Utah University in Cedar City, UT. After receiving a Ph.D. degree from the University of Nebraska in 1987, he joined the faculty at the Air Force Institute of Technology, where he taught undergraduate and graduate courses in earned value cost management for more than 10 years. David is a CPA, CMA, CGFM, and CCE/A, and is active in several professional associations, including the Society of Cost Estimating and Analysis, the American Accounting Association, and the Institute of Management Accounting. Presently, David serves as associate editor for the *Journal of Cost Analysis.* He has published extensively in the area of earned value cost management in *Acquisition Review Quarterly, Project Management Journal, National Contract Management Journal, Journal of Parametrics, National Estimator,* and the *Journal of Cost Analysis.*

(E-mail address: Christensend@suu.edu)

## References


Abba, W. (1995, October). Earned value management rediscovered! [World Wide Web home page for Earned Value Management]. http://www.acq.osd:80/pm/newpolicy/misc/abba_art.html.

Abba, W. (1997, January-February). Earned value management—Reconciling government and commercial practices. *Program Manager, 26,* 58–69.

Beach, C. P. Jr. (1990, November). A–12 administrative inquiry. (Report to the Secretary of the Navy). Washington, DC: Department of the Navy.

Christensen, D. S. (1996, Spring). Project advocacy and the estimate at completion problem. *Journal of Cost Analysis,* 61–72.

Christensen, D. S., & Heise, S. (1993, Spring). Cost performance index stability. *National Contract Management Journal, 25,* 7–15.

Christensen, D. S. (1994, Winter). Cost overrun optimism—Fact or fiction? *Acquisition Review Quarterly, 1,* 25–38.

Christensen, D. S., Antolini, R. C., & McKinney, J. W. (1995, Spring). A review of estimate at completion research. *Journal of Cost Analysis,* 41–62.

Dahlberg, K. E., Colantuono, F., & Fischer, R. W. (1992, Winter).Linking C/SCSC + MMAS + WIP: A discussion of the primary contractor planning/execution systems and government requirements. *Government Accountant's Journal,* 5–11.

Defense Contract Audit Agency. (1996, January). *DCAA contract audit manual.* Pittsburgh, PA: U.S. Government Printing Office.

Department of Defense. (1996, December 12). *Earned value management implementation guide.* (Revision 1 was incorporated on Oct. 3, 1997. The OPR is Defense Logistics Agency/AQOF).

Drezner, J. A., Jarvaise, J. M., Hess, R. W., Hugh, P. C., & Norton, D. (1993). *An analysis of weapon system cost growth.* Santa Monica, CA: RAND.

Fleming, Q. W. (1992). *Cost/schedule control systems criteria* (Rev. ed.). Chicago, IL: Probus Publishing.

Fleming, Q. W., & Koppelman, J. M. (1996). *Earned value project management.* Project Management Institute.

General Accounting Office. (1997, May 5). *Significant changes in DoD's earned value management process.* Washington, DC.

Little, A. D. Inc. (1984, August 15). *Survey relating to the implementation of cost/schedule control systems criteria within the Department of Defense* (Report to the Assistant Secretary of Defense [Comptroller] Phase II). Author.

Office of Management and Budget. (1997). *Principles of budgeting for capital asset acquisitions.* Washington, DC: Government Printing Office.

Oyer, D. J. (1992). Activity-based costing in government contracting. In Barry J. Brinker (Ed.), *Handbook of cost management* (pp. C4-1–C4-39). Boston: Warren, Gorham & Lamont.

## ENDNOTES

1. More formally, earned value is defined as "the value of completed work expressed in terms of the budget assigned to that work" (DoD, 1996, p. 63).

2. Indirect cost may not be allocated to the detailed levels of the work (e.g., control accounts and work packages).

3. Historically, a significant variance was one that exceeded a prespecified limit (e.g., percentage of the budget, or a dollar amount, or both). When applied arbitrarily to all levels of work on the contract, it can result in excessive analysis and reporting. Recently, definitions of significance have been modified to reduce the number of frivolous variance investigations and reports.

4. Presently, there is no requirement that promising cost assignment methods like activity-based costing (ABC) be used. But the criteria are not incompatible with ABC, and DCAA is not blocking defense contractors from adopting it (Oyer, 1992).

5. Cost management data on Acquisition Category I (ACAT I) programs are routinely summarized by program offices and sent to the Office of the Secretary of Defense for inclusion in the Defense Acquisition Executive Summary (DAES) data base. In addition, selected data from the CPR are included in a comprehensive annual report of ACAT I programs to Congress.

6. The criteria do not specify how frequently the comprehensive EAC should be developed. The *Earned Value Management Implementation Guide* (DoD, 1996) recommends that the comprehensive EAC be developed "periodically" at the control account level (para 3-6e).

7. Each of the Services has had programs with severe cost and schedule problems. According to Abba (1995, p. 1), "Cost problems on the Army's AAWS–M (Javeline) and the Air Force's C–17 were all shown to be foreseeable, if not avoidable, using earned value reports from the contractors' C/SCSC management control systems."

8. The special access nature of the program interfered with higher level oversight of the A–12's cost performance. For example, the cost management staff at the Office of the Secretary of Defense (OSD) was not cleared for access to the data until March 1990. Adverse cost and schedule variances that would have normally prompted investigations by OSD were delayed by more than a year (Beach, 1990, pp.7–8).

9. For example, using a sample of 155 contracts and an alpha of 5 percent, Christensen and Heise reported that the cumulative CPI does not change by more than 10 percent from its value at the 20 percent completion point.

10. An unfavorable schedule variance does not necessarily imply that work is behind schedule. By itself, the SPI reveals no critical path information. The SPI should be used in conjunction with other schedule information (Fleming, 1992).

11. Christensen et al. (1995) reviewed 25 studies that compared the accuracy of dozens of EAC formulas. The most accurate formulas used the CPI, the SPI, or the CPI x SPI as the performance factor. In addition, defense manuals that describe the EAC calculation, and standard DoD CPR analysis software, invariably include these index-based formulas as standard options in computing the EAC. Because cost and schedule problems can drive future costs, using both CPI and the SPI in the performance factor is popular. Multiplying the CPI by the SPI is a crude but simple attempt to adjust the CPI by the adverse influence that schedule problems can have on cost growth.

# THE PROBLEM WITH AVIATION COTS

**Lt Col Lionel D. Alford, Jr., USAF**

Commercial off the shelf (COTS) has become a byword for acquisition reform, but there are significant risks associated with the use of COTS products in military systems. These risks are especially acute for aviation systems. This article explains how COTS can negatively affect military acquisitions and gives ideas on how to plan and resolve COTS-caused problems.

To take advantage of the fast pace of technological advances in industry, the Department of Defense (DoD) is acquiring commercial products and components for use in military systems. Using these commercial items, called commercial off the shelf (COTS), provides the DoD with numerous potential benefits. Primarily, COTS purchasing allows military acquisition to incorporate new technology into military systems more quickly than do typical developmental programs. COTS can also reduce research and development costs. Even more important, the DoD has looked to COTS purchases to help reduce operations and support costs for military systems. Figure 1 shows why this is highly desired by the DoD; the cost of operations and support is almost three quarters the overall cost of a typical system (Jones, 1994; Phillips, 1996).

With this in mind, what could be the worst misfortune to befall an item procured as COTS? What if the item changed and the original was no longer available commercially? What if its commercial replacement would no longer work in the military system for which it was procured? The very worst misfortune, which incorporates both of these problems, would be if the item were suddenly to become government-unique, with no replacement available commercially. Becoming government-unique wouldn't entirely defeat the purpose of a COTS acquisition, but it would significantly affect support, the longest tail, and as Figure 1 shows, the greatest cost in the acquisition life cycle.

This misfortune could never affect our COTS procurement—or could it? When you have finished reading this article, you will realize that not only *can* it affect your

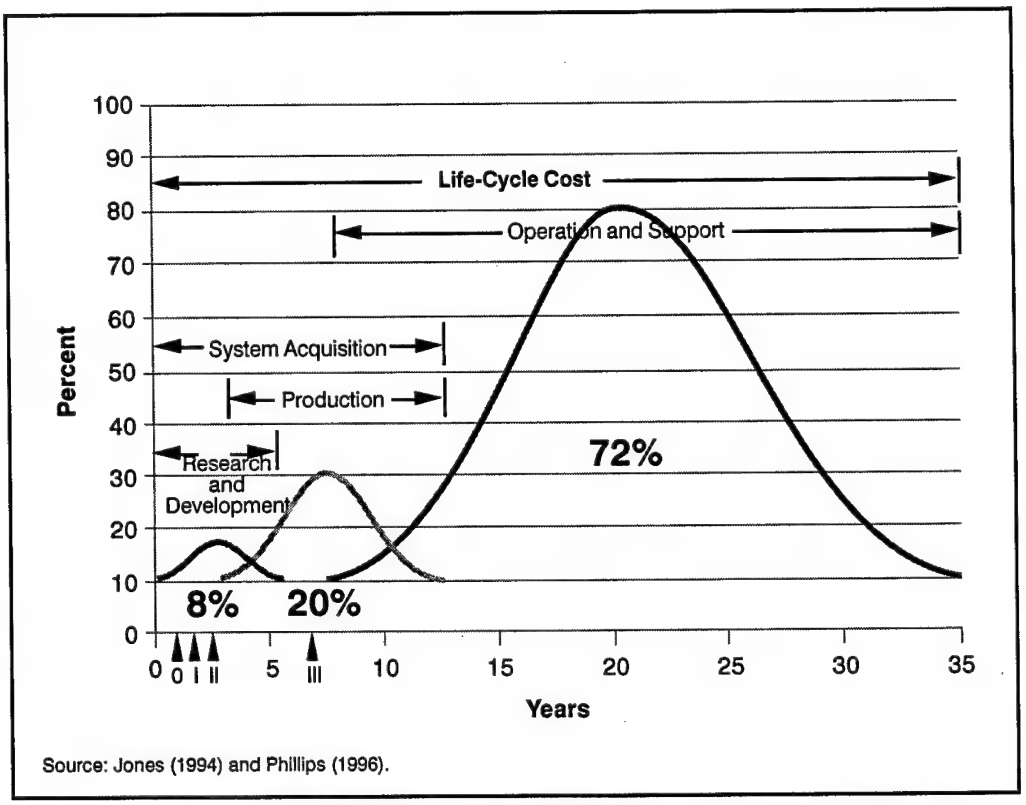



**Figure 1. Typical Cost Distribution of a System**

COTS procurement, but if you are acquiring aviation parts and systems, it probably already *has*. In any COTS acquisition, the acquirer needs to have already planned and prepared for this eventuality. This article shows how to plan for and gives ideas on how to constrain this COTS problem.

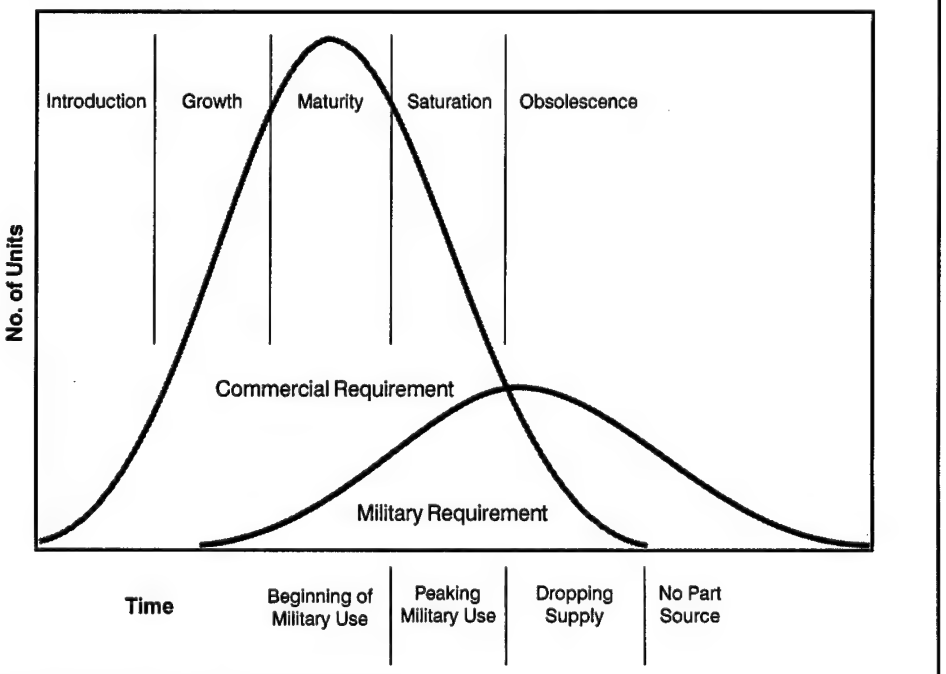
A COTS item can become government-unique whenever the manufacturer discontinues or makes a change to the item. If the item is changed, its original becomes government-unique when the government either doesn't acquire the variant or doesn't reflect the change in the systems incorporating the item and the systems' documentation. (A system, in this definition, is the higher-level mission component that the item is procured to support. For example, an aircraft and its support equipment is a system; a radio installed in the aircraft is an item.)

After a manufacturer makes a change to an item, its new variant might possibly be purchased and used without any negative effect to the system for which it was procured. In this case, even though the original item is now government-unique, the change didn't affect the form, fit, interface, or mission characteristics of the device. Unfortunately, manufacturers' changes routinely affect form, fit, interface, and mission characteristics, and the effects of these COTS item

changes for systems incorporating them are significant.

The problems of changing form, fit, and interface should be obvious; these characteristics generally cannot change if the variant item is to be installed and to operate correctly. The acquirer must usually make modifications to the system to accommodate form, fit, and interface changes. Changes to mission characteristics do not necessarily result in modifications to the system, but they can cause significant problems if they affect the overall ability of the system to perform. For example, if the new item has a temperature range less than the original, the system could possibly fail when it is used outside the bounds of that temperature range.

The most devastating cause of government-uniqueness is when a manufacturer discontinues an item. Figure 2 shows that for a large number of COTS acquisitions, this result is inevitable (U.S. Air Force Program Executive Office). The life of a typical military acquisition exceeds 20 years, yet the life of a typical civil product, especially in electronics, is much less. From our own experience we know that it is almost impossible to purchase an "ancient" Z80-based computer, but right now the Z80 lives on in the Air Force's AP–102 computer. This problem is not isolated to the electronics industry. For example, aviation "steam gauges," the mechanical gauges on instrument panels, are becoming nearly impossible to obtain —electronic gauges are replacing them.




Source: U.S. Air Force Program Executive Office (199?).

**Figure 2. COTS Obsolescence**

The above concepts provide the definitive framework under which COTS must be understood: The manufacturer is free to make changes to or even discontinue the manufacture of the COTS item without notice. As long as item changes don't affect form, fit, interface, mission characteristics, or supply, there is no problem for the acquirer. The problem is that the acquirer has no control over these changes. When changes do affect form, fit, interface, mission characteristics, or supply, these changes become a significant problem for any COTS acquisition. This is especially true for aviation COTS.

## Aviation-specific Problems

The effect of a manufacturer's changes to aviation COTS can be boiled down to two specific difficulties, airworthiness and forced modifications. Airworthiness is the primary safety characteristic of any aircraft. It is the primary element proven in the testing of the aircraft. The Federal Aviation Administration (FAA) certifies the airworthiness of most COTS items for aircraft. These items must be certified in the system as well as individually.

**"The effect of a manufacturer's changes to aviation COTS can be boiled down to two specific difficulties, airworthiness and forced modifications."**

Military system certification, except for FAA-certified aircraft, is accomplished wholly by the aircraft's configuration management (CM) authority. What this means for COTS articles is that a simple change of mission characteristics, including improved functionality, will always drive a recertification of the aircraft. This recertification can range from a paper review to full flight test. Considering the rate of change of COTS items, this is a daunting prospect for the CM authority. In addition, COTS item changes can also drive a change to the specifications and technical data of any system on which these items are installed—also a daunting prospect.

The other difficulty for aviation COTS, which also affects any system, is forced modifications. A forced modification is one that is caused by the change of form, fit, interface, function, mission characteristic, or supply of the item. When supply is affected, the acquirer must support the discontinued item or find a replacement. The latter may force a modification.

More common in aviation COTS is an FAA-directed change to an item called an airworthiness directive (AD) FAA, 1996).[1] Airworthiness directives are Federal Aviation Regulation (FAR)-based orders that mandate a change to an aviation item or system. These directives are regulatory in nature and "no person may operate a product to which an airworthiness directive applies except in accordance with the requirements of that airworthiness directive" (FAA, 1996).

The manufacturer has two choices in implementing the AD: Discontinue the product or make the required change. The user of the item also has two choices: Get a replacement product, if available, or make the changes required by the directive. When the change affects the form, fit, or interface of the item, an AD forces a modification to the system to accommodate the item. For FAA-certified aircraft, the system must also be certified

by the FAA for flight. For government-certified aircraft, to comply with such an AD, the CM authority must modify the system and certify airworthiness.

But there is no requirement for the government to change its COTS items to accommodate an AD. In such cases, the item becomes government-unique. Because the government self-certifies, it is not uncommon for non-FAA-certified government aircraft to not make AD-directed changes.

Further, because the government in many cases does not subscribe to technical changes from manufacturers, the CM authority may not be aware of ADs to a system's components.

This problem is exacerbated when the CM has established a depot for a COTS acquisition and is, in that case, supporting the component without knowledge of or real commonality with the original item. ADs are not an isolated or uncommon problem. In the case of aircraft, ADs normally occur more than once per year on even well-established air vehicles, and it is typical to have thousands of ADs affecting a single aircraft model.

All this boils down to the fact that, for aviation, a COTS item will become government-unique in a very short period of time—from a few months to a year after the acquisition of the item. Government uniqueness means forced review, modification, support changes, and recertification when the change is recognized—or blissful ignorance and risk if the change is not recognized.

## Some Solutions

What can be done to prevent these problems for aviation systems specifically and all systems generally? One solution has been hinted at, and this solution has been accomplished with varying degrees of success since the first acquisition of COTS items. This is the acknowledgment of an item's potential government-uniqueness before the manufacturer makes any changes. In this strategy, the acquirer purchases spares and builds a government depot activity to support the item. This solution does take advantage of the COTS item commercial development, but the overall cost savings may not be significant because the longest tail—the support tail—is at least as long as any normal government item development. In fact, the support tail may be costlier because the government has not been involved in the item development.

**"Another solution is to purchase enough spares for the total life of the system and item."**

Many programs use this strategy; the C–130 improved auxiliary power unit program is one example. Another solution is to purchase enough spares for the total life of the system and item. The AP–102 computer program used this strategy to ensure sufficient Z80 chips to support the life of the system. Again, this is not an optimum solution because it usually increases the item's logistics tail. In this case, if the item's life expectancy is less than predicted or the item's life is extended, the government has no other recourse than to entirely replace the item or to develop a

support capability. These two solutions, government depot and lifetime spares buy, prevent forced modifications and subsequent airworthiness certification requirements, but as discussed above, they also can introduce risk. They also defeat two major potential advantages of COTS: the ability to reduce the support tail and the chance to take advantage of future commercial developments in the item.

There exist four other solutions to these problems that do take full advantage of the possibilities of COTS acquisition, but they are each fraught with their own risks. Each is a variant of what is commonly known as contractor logistics support (CLS). In the first alternative, the acquirer can purchase the servicing information support of the manufacturer. This allows the CM authority to make decisions based on changes to the item. If the CM authority knows of a manufacturer's changes to an item, they can choose to acquire a replacement or modify the system as required to allow continued use of the variant item (Defense Systems Management College, 1997).

**"There exist four other solutions to these problems that do take full advantage of the possibilities of COTS acquisition, but they are each fraught with their own risks."**

The risks involved in this are three. First, when an item changes, there is the cost to acquire and certify a new item if the decision is made to replace it. Second, there is the cost to certify and possibly modify the system if the item is retained. And third, there is the cost to set up support if a decision is made to not make any changes to the item. The advantages of retention or replacement are the continued COTS logistics tail and guaranteed item certification. System recertification is still required. If the item is retained in its original configuration, the decision to support a now government-unique item leads to a typical high-cost government logistics tail. To my knowledge, this pick-and-choose method of systems support has not been used intentionally; however, after a manufacturer has made unexpected changes to a COTS component, many programs have found themselves in this situation.

The second alternative is that the acquirer can purchase manufacturer support for the item. The risks in this are similar to that of purchasing servicing information support; however, the manufacturer has more incentive to keep the item within form, fit, and interface configuration for the system. When changes in the system are required to support changes in the item, the manufacturer can aid the CM authority. This is a very common method used to support COTS.

In the third alternative, the acquirer can purchase the full, integrated support of the manufacturer. This allows the manufacturer to make changes to the system along with changes to the item. The contractor may have some total system performance responsibility (TSPR), but the CM authority must still recertify the system. The AC–130U is using this method to manage COTS in its new integrated weapon system support program. This is the most common method used today to support COTS items and systems through CLS.

The fourth solution is for the acquirer to purchase full system support that would allow an integrator to automatically make the necessary changes to the system to

accommodate any item changes. In this scenario, the contractor would have TSPR and certify the weapon system. This fourth option is used now primarily to support FAA-certified government aircraft. It could potentially be used to support any government aircraft or system incorporating COTS items.

The message should be plain. COTS acquisitions lead the acquirer down two support paths: the government-unique high-cost logistics tail and the COTS manufacturer support tail. Both paths involve risk and guarantee future costs for any system incorporating COTS items. The potential of COTS acquisitions is embodied in a lower cost development, initial acquisition, and support costs, but that potential must be balanced with the knowledge that COTS acquisitions will either force modifications and recertifications or lead to a typical government-unique logistics tail.

COTS for aviation isn't dead, but it isn't a simple solution to aircraft and aviation acquisitions. It requires careful planning and forethought that must be incorporated into any program contemplating a COTS acquisition.

**Lt Col Lionel D. Alford, Jr.,** U.S. Air Force, is an Aeronautical Test Policy Manager for Headquarters, Air Force Materiel Command, Wright-Patterson Air Force Base, OH. He is an experimental test pilot who has logged more than 3,600 hours in more than 40 different kinds of aircraft. He is a member of the Society of Experimental Test Pilots. Alford is a graduate of DSMC's APMC 98-1. He holds an M.S. degree in mechanical engineering from Boston University and a B.S. in chemistry from Pacific Lutheran University.

(E-mail address: Lionel.Alford@wpafb.af.mil)

## REFERENCES

Defense Systems Management College. (1997, December). *T5-610 acquisition logistics and systems engineering, technical perspective: Logistics management.*

Federal Aviation Administration. (February 1996). *Part 39—Airworthiness directives, Federal Aviation Regulations.* Washington, DC: Government Printing Office.

Jones, J. W. (Ed.). (1994). *Integrated Logistics Support Handbook* (2nd ed.). Defense Systems Management College Press, Fort Belvoir, VA.

Phillips, J. F. (1996, September). Deputy Under Secretary of Defense.

U.S. Air Force Program Executive Office. *Obsolescence crisis. Joint stars: Joint surveillance target attack radar.* Briefing.

## ENDNOTE

1. An example of airworthiness directives can be viewed at www.safetydata.com

# DEPOT UTILIZATION AND COMMERCIALIZATION

*William N. Washington*

The excess capacity that currently exists within DoD maintenance depots presents an extra burden of overhead expenses. The remedies fall into two categories. The first represents what the Services have been doing through the base realignment and closure process: closing and moving workload to the fewer remaining depots. The second approach is to find a new use for the depots through commercializing their facilities, and bringing in work from outside the current DoD maintenance system. This article discusses both proposed solutions, their potential problems, and the changes needed to ensure their success.

During the past several years, the Department of Defense (DoD) has been involved in an ongoing effort to reduce costs across a broad range of functional areas. One of these has been the closure and consolidation of military repair depots, which has reduced the infrastructure and overhead costs associated with the facilities. But this process has not led to an even reduction across cost areas—the military workload at the depots has been reduced further than the depot overhead expenses (Figure 1 [Leiby, 1998]). While the work has gone away (variable costs), the facilities themselves still have expenses that are not tied one-to-one with the workload (fixed costs). Here we will explore this situation, and discuss what can be done to reduce those costs.

Military repair depots, geared to perform unique functions that in many situations are not available in the private sector, provide specialized repair and support for defense systems. As such, their equipment and facilities are developed to support military hardware whose requirements are beyond commercial needs. The military has sought to save money primarily by closing existing depots and transferring the workload to remaining installations. This process has reduced the number of major Army repair depots from 10 to 5.

But the remaining Army depots are not working up to capacity, and so there is

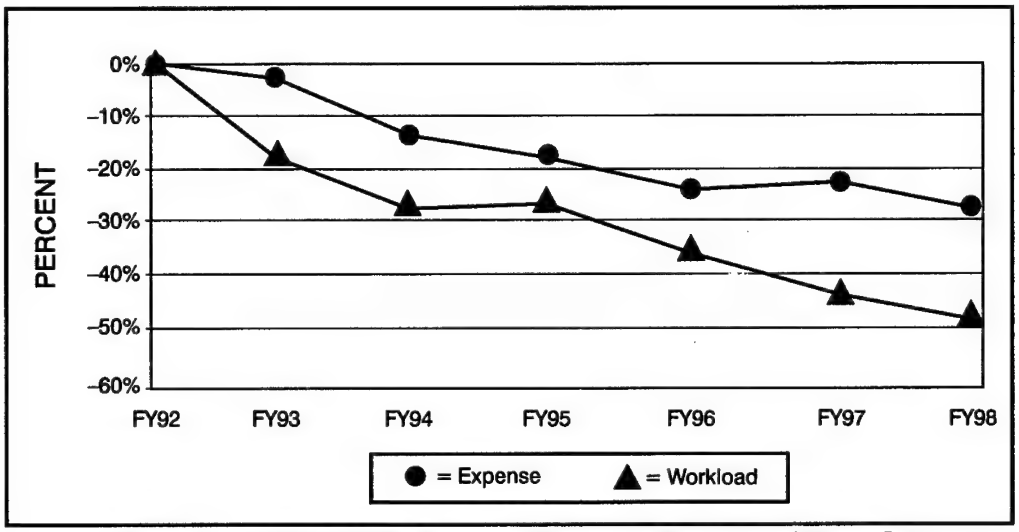



**Figure 1. Depot Maintenance Cost and Workload Trends**

room for additional savings. (Two depots are running at 60 percent utilization and the remainder are at 73–85 percent, as of February 1997 [Industrial Operations Command (IOC) Briefing, 1998]). These statistics will probably worsen with time, with the reduced need for military repair (i.e., reduced operations tempo and number of systems maintained), and the significant shift in new weapon system repair designation away from the depots. (From 1987 to 1997, the military has made a significant effort to have new weapons systems maintained by their developer [General Accounting Office (GAO) (2), March 1998].) The latter has led to a significant shift in responsibility: In 1987 75 percent of new weapons systems repairs were done at depots; in 1997, just 18 percent were.

That downward momentum is likely to continue; the gap between depot workload and capacity requirements will likely increase. The political reality is that further depot closings are not in the cards, however; so we should consider expanding their use.

## Problems With Consolidation and Privitazation

Previous depot consolidations and privatizations have experienced the following:

- The savings did not materialize.
- Sufficient information was not available to let a fixed-price contract for performing the mission.
- The government-furnished material needed for the repair process was not provided in a timely manner, thus causing contractor cost overruns and lawsuits for damages.
- The environmental costs of cleaning up the facility have been substantial, and have been difficult to accurately estimate.

In addition, one must review several considerations prior to closing a depot:

- Surge capacity must be retained for wartime requirements.
- Unique hardware can be expensive to move, and may not function properly in other geographic areas (such as outdoor test sites).
- Legal and policy barriers may prevent outsourcing the depot work.

Problems with privatization and outsourcing are perhaps the greatest drawbacks in trying to reduce depot costs, as several prior government privatization and outsourcing efforts show (Kitfield, 1998). For example, in 1995 the Air Force awarded contracts to outsource the Aerospace Guidance and Metrology Center at Newark Air Force Base, OH. The GAO study on this effort found that privatization of the center would not generate the projected 20–30 percent savings. In fact, the yearly savings were so minimal that it could take upwards of 100 years for the Air Force to achieve that magnitude of savings (Concannon, 1996, and GAO, December 1994).

Just recently, GAO was asked to review a new Air Force interim study on the project. This effort indicated the minimal expected savings had not materialized, and, in fact, the outsourcing was costing the Air Force 16 percent more than when it ran the center itself (GAO, December 1997). These results are further supported by a GAO study that reviewed public-private competitions on depot repair (GAO, April 1996). It found that the depots won 67 percent of the competitions, with depot bids averaging 40 percent less than the private sector.

Further, GAO concluded that privatization of highly skilled technical maintenance performed at military depots may not generate the expected savings due to a number of factors, such as the specific technical nature of military equipment, the lack of competitive private sector companies that can perform these jobs, and that the reported savings on previous government outsourcings were overoptimistic and did not reflect subsequent cost overruns, modifications, or add-ons (GAO, July 1996; GAO, December 1996; and GAO, May 1997). As a product of the above uniqueness of military depots, GAO also discussed the lack of adequate competition to reduce costs.

In a review of public-private competitions on depot repair, the GAO (April 1996) found that for 23 percent of the competitions there were no offerers from the private sector, and for another 35 percent there was only one private sector bidder. Further, a review of 240 depot maintenance contracts showed that 76 percent of them were awarded sole source. This trend seems to be worsening, with a new GAO report (June, 1998) indicating that DoD is now awarding 91 percent of the current depot contracts (fiscal year 1996–March 1997) noncompetitively, mostly to the original equipment manufacturers, since the government either did not have the data rights to that equipment, or could not precisely define the requirements for their repair.

**"Problems with privatization and outsourcing are perhaps the greatest drawback in trying to reduce depot costs...."**

The Army's sole-source percentage appears to be even higher than the DoD average, with 95 percent of the depot contracts being let sole-source. This represents 99 percent of the total dollar value of all Army depot contracts. This situation is worsened by the fact that only 32 percent of those contracts were fixed price, leaving the majority of them subject to possible cost increases.

Part of the problem with the Newark outsourcing was that the Air Force lacked good pricing data on how much it would cost to perform the missions. As a consequence, the contractors would not accept a fixed-price contract, and required the Air Force to use a cost type of contract (Valley, 1997). Spaulding (1997) also pointed out that another reason that the cost type of contract was selected for Newark was so that equitable treatment of former government employees and unanticipated contractor costs could be provided. This allowed the contractor to match the government benefits that existed previously for those employees, which were higher than what the contractor normally provided.

**"Part of the problem with the Newark outsourcing was that the Air Force lacked good pricing data on how much it would cost to perform the missions."**

In terms of problems with moving depot facilities, the recent movement of the workload at Alameda Naval Aviation Depot to other depots (Jacksonville Naval Aviation Depot and San Antonio Air Logistics Center) produced delays and increased costs for the engine repair work that was transferred (GAO [1], March 1998). These problems were attributed to conflicting priorities between the gaining and losing facilities, unidentified equipment and retooling requirements, limited access to cross-service spare parts, outdated technical data, personnel and equipment certification requirements not being consistent, and shortfalls in the number of skilled workers.

Another problem the Services would want to avoid is what occurred at Red River Army Depot (RRAD), where the Base Realignment and Closure (BRAC) process stripped all the non-Bradley Fighting Vehicle workload from the depot. This left RRAD initially with about 86 percent excess capacity, which substantially increased their operating costs by $15 per hour, due to fixed costs remaining the same with a much lower workload over which to spread the costs (Newby, 1997). Some of these costs have been brought down by closing or tearing down several of the buildings on the installation, but it still remains the most expensive Army repair facility.

A similar situation occurred at Newark (Spaulding, 1997) when it was privatized-in-place, causing its rates to increase. These findings are supported by several reports (Defense Science Board [DSB], 1996; GAO, April 1996; GAO [1], September 1996; GAO [2], September 1996) that also stress the problems of increased capacity as a result of privatization-in-place. For instance, the GAO found that for 79 percent of the contract items in the Newark privatization, the costs had actually increased, causing the overall costs to have a net increase in rates of $6 million (GAO, April 1996).

Lastly, as former Rep. Earl Hutton, then subcommittee chairman for the House

Readiness Panel, commented on the move to dismantle the depot system: "The organic maintenance capability [of the Defense Dept.] is far too important to the readiness of the forces to be susceptible to the difficulties being experienced by the defense industrial base." "We need to be careful not to dismantle a capability that will risk readiness and cost billions to reconstruct" (Morrocco, 1994). A similar note was struck by former Secretary of the Air Force Sheila E. Widnall ("Widnall clarifies depot decision," March 1995), who stated that "undertaking large, unbudgeted efforts like depot closures would jeopardize future re-capitalization and modernization of Air Force programs."

Given these considerations, the closure, outsourcing, or privatization of depot facilities may not be the best approach to rectify the problem of underused capacity at this time.

## Commercialization of Depots

A better alternative to these practices, in our current environment, would be to look at options that would change the function of the depot, so that we would retain surge capacity but still reduce costs by fully utilizing existing facilities. This alternative is in keeping with the DoD guidance to promote commercialization of military depots (DoD, 1996), and could be two forms.

The first is commercial work. A recent GAO Report (May, 1998) discusses that these types of arrangements are legal under Title 10 of the *U.S. Code,* and have been successful in bringing new funds to the depots, through direct sales (in which the government facility acts as a subcontractor for private industry), and through workshare (in which the program manager sends funds directly to the depot for part of the work, and awards a contract to private industry for the remaining portion).

The second is cooperative research and development agreements (CRADAs) for teaming or technology transfer projects with small businesses receiving government grants, universities, and government laboratories.

Currently, direct sales represent about 99 percent of the external work being performed by the Army depots (Kopp, 1998); other alternatives could provide additional work for the depots that, in turn, would bring in additional funding, and reduce overhead costs for all the depot's customers, both military and commercial. However, in order to fairly implement a commercialization of the depots, we would need to institute something similar to activity-based costing (ABC) in order to assure that the commercial customers would not be subsidized by the government. This is because of the way the depots currently keep track of costs, which allocates the costs of services across all the separate repair actions performed, and does not allow for pricing of specific work (this concern about adequate pricing of depot repairs has also been voiced by the Defense Science Board's *Report on Outsourcing and Privatization* [DSB, 1996]).

**"Currently, direct sales represent about 99 percent of the external work being performed by the Army depots...."**

ABC focuses on identifying the activities that are responsible for the costs associated with a product. As such, activity

costs are passed on to products or services only if the product or service uses that particular activity. For instance, as the number of activity measures increase (i.e., functions that contribute a cost to a product, such as multiple processing steps, multiple skill levels from different functional areas, multiple machine or tooling requirements, allocation of overheads to products and services according to the demand by each activity), ABC is better able to capture the underlying economics of the organiza-tion's operations, and identify the "true" costs (true expenses and unit costs by service line, function, and client) for producing a product or repair action.

**"Through these programs, the Services leverage the best universities in the nation to advance the state of science in areas of interest to the military."**

This increased visibility into the cost of performing a service or manufacturing an item has been very popular in private industry, with hundreds of articles written on its use and benefits. In other words, there should be a firewall between projects performed for private industry and regular Service repair workload, so that the "true" costs of performing "outside work" can be determined.

The teaming and technology transfer projects might involve several aspects, ranging from just commercial work to projects with technology transfer incubators, small business innovation research (SBIR), and small business technology transfer (STTR). This approach could serve as a bridge between commercial, government and university research, and development and production applications (Washington, 1997); and could incorporate existing federal, state and local funding initiatives on promoting small businesses (which in 1988 represented $550 million to promote technology innovation [Peterson, 1993]). It might also tie into the Services' Centers of Excellence Programs or the OSD-funded university research initiatives.

These programs have been expanding somewhat to now also include joint university-industry research projects (Gaumond, 1994), and the Army Research Laboratory's "federated laboratory" concept (Army Research Laboratory, 1994). The Advanced Research Projects Agency (ARPA) is also funding engineering programs through its Technology Reinvestment Project (TRP) initiative, in conjunction with the National Science Foundation (Wax, 1995). Through these programs, the Services leverage the best universities in the nation to advance the state of science in areas of interest to the military. It would make sense for our depot system to join in this process, and benefit not only these existing programs but our depots as well.

## Other Considerations

Dennis Urban (Urban, 1998) at the U.S. Army Industrial Operations Command (IOC) has mentioned several possible actions that might also be taken to reduce costs in depots:

- Modernize facilities, so they are more cost effective to operate.

- Move processes into smaller buildings on the depot property, and close the larger buildings.

- Increase training, so that depot personnel have cross-skill carryover to work on multiple types of projects.

- Sell excess equipment that is not used, or only marginally used (if outside resources exist that can perform the function at less cost than maintaining the equipment [cost plus depreciation]).

## Summary and Discussion

The commercialization of the depots would provide small businesses and universities with an applied engineering program, advanced manufacturing knowledge, and state-of-the-art laboratory and manufacturing resources. It would bring to the depots outside work and money that would lower their costs by fully utilizing existing personnel and facilities. Further, through working with other government and Service programs to promote technology transfer and areas of science of interest to the military, it would help both these programs and the depots.

In order for the commercialization of the depot process to proceed, however, it will be necessary to institute an ABC program in the depots, to assure that government funds are not subsidizing commercial businesses, especially contractors who are competing with one another for government contracts. In addition, commercialization will have some up-front costs. They would take the form of costs for the new (ABC) accounting system and the costs associated with attracting business to the depots (e.g., advertising, transaction costs).

Lastly, there could be a concern about the government competing with private industry, which has been voiced over the past couple of years, as other government commercialization efforts have ventured into performing outside work. However, taking these considerations into account, it still seems that the most viable solution is for the Services to commercialize their depots. This effort should be achievable with minimum costs to the Services and should not receive significant private industry criticism if the process were handled as a cooperative versus a competitive venture with them.

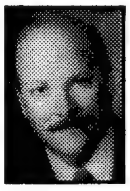
Several of the DoD laboratories have pursued this strategy over the past few years, though not always successfully. So significant lessons can be gleaned from their efforts to commercialize their facilities, such as what media (e.g., trade shows, journals, etc.) have served as the best mechanism for attracting industry participation. Secondly, it may be easier to interest outside participants in having work performed at depots than in the laboratories, for depots deal with the basic process of manufacturing, rather than the more complex world of developing new systems and materials. The feasibility of this approach is exemplified by several initial efforts

**"Lastly, there could be a concern about the government competing with private industry, which has been voiced over the past couple of years, as other government commercialization efforts have ventured into performing outside work."**

where the depots have already formed contractual agreements to manufacture components for industry (Kopp, 1998).

How do we avoid criticism from private industry? If the projects brought into the depot are cooperative ventures with private industry, rather than competitions with them, criticism should be minimized. These cooperative ventures could also offer significant cost benefits to industry, for, as mentioned earlier, depots have been successful in their competitions with private industry, winning 67 percent of the competitions, and with costs averaging 40 percent less (GAO, April 1996).

Commercialization of military depots would seem to be a viable solution to the problem of increasing overhead costs and underuse of depot facilities. The commercialization of the depots could also provide both industry and universities with several benefits, such as an applied engineering program, advanced manufacturing knowledge, and state-of-the-art laboratory and manufacturing resources.



**William N. Washington** is an operations research analyst for the Directorate of Resource Management, HQ CECOM, Fort Monmouth, NJ. He has a B.S. degree from Kansas State University and an M.S. degree from Trinity University. His doctoral studies were in measurement, evaluation, and research design at Michigan State University. He is a graduate of the Army Acquisition Corps Senior Service College (1995), and APMC (96-2). He has received the Secretary of the Army's Award for Outstanding Achievement in Materiel Acquisition (1994), a DoD Award for best paper at the 31st DoD Cost Analysis Symposium (1998), the Assistant Secretary of the Army (FM&C) Author of the Year Award (1997), a DA Achievement Medal for Civilian Service (1998), and the Army Materiel Command's Cost Analysis Award for Modeling (1988). His recent articles on acquisition topics range from education and training to contracting issues and cost savings. A member of the Army Acquisition Corps since its inception, he is rated Level III in career fields A, K, and S.

(E-mail address: washinwn@mail1.monmouth.army.mil)

## References


Army Research Laboratory. (1994, December 14). Federated Laboratory Board Agency announcement: Research partnerships between ARL and private sector laboratories. *ARL-95 Fed. Lab. BAA.*

Concannon, M. R. (1996, Fall). DoD outsourcing/privatization: Panacea or Pandora's box? *Supportability Investment Decision Analysis Center Newsletter, 5*(2).

Defense Science Board (DSB). (1996, August). *Report of the Defense Science Board on outsourcing and privatization* (DTIC ADA316936). Washington, DC: Office of the Under Secretary of Defense for Acquisition and Technology.

GAO. (1994, December 9). *Aerospace Guidance and Metrology Center: Cost growth and other factors affecting closure and privatization* (GAO/NSIAD-95-60). Washington, DC: Author.

GAO. (1996, April). *Defense depot maintenance: Privatization and the debate over the public-private mix* (GAO/NSIAD-96-146). Washington, DC: Author.

GAO. (1996, July). *Defense depot maintenance: Commission on roles and missions privatization assumptions are questionable* (GAO/NSIAD-96-161, DTIC ADA314086). Washington, DC: Author.

GAO. (1) (1996, September). *Army depot maintenance: Privatization without further downsizing increases costly excess capacity* (GAO/NSIAD-96-201, DTIC ADA315219). Washington, DC: Author.

GAO. (2) (1996, September). *Navy depot maintenance: Cost and savings issues related to privatizing-in-place at the Louisville, Kentucky, depot* (GAO/NSIAD-96-202, DTIC ADA317434). Washington, DC: Author.

GAO. (1996, December). *Air Force depot maintenance: Privatization-in-place plans are costly while excess capacity exists* (GAO/NSIAD-97-13). Washington, DC: Author.

GAO. (1997, December). *Air Force privatization-in-place: Analysis of aircraft and missile guidance system depot repair costs* (GAO/NSIAD-98-35). Washington, DC: Author.

GAO. (1997, May 1). *Defense depot maintenance: Uncertainties and challenges DoD Faces in restructuring its depot maintenance program* (GAO/NSIAD-97-112, DTIC ADA324498). Washington, DC: Author.

GAO. (1) (1998, March). Depot maintenance: Lessons learned from transferring Alameda Naval Aviation Depot engine workloads (GAO/NSIAD-98-10BR, briefing report). Washington, DC: Author.

GAO. (2) (1998, March). *Defense depot maintenance: DoD Shifting more workload for new weapons systems to the private sector* (GAO/NSIAD-98-8). Washington, DC: Author.

GAO. (1998, May). *Defense depot maintenance: Use of public-private partnering arrangements* (GAO/NSIAD-98-91). Washington, DC: Author.

GAO. (1998, June). *Defense depot maintenance: Contracting approaches should address workload characteristics* (GAO/NSIAD-98-130). Washington, DC: Author.

Gaumond, C. (1994, December 7). Interview. Office of Research and Laboratory Management, University Research Initiative Program, Under Secretary of Defense for Acquisition, December 7, 1994.

IOC. (1998, January 1). *Ammunition plant, arsenal and depot maintenance capacity, utilization and funding, Rock Island Arsenal, IL.* Briefing.

Kitfield, J. (1998, June). Off base. *Government Executive,* 28–34.

Kopp, J. (1998, June 9). Interview. General engineer, U.S. Army Industrial Operations Command.

Leiby, B. (1998, November 30). Army working capital fund myth. Draft article (BLEIBY@alexandria-emh1.army.MIL).

DoD. (1996, January 18). Maintenance of military equipment. Plan for increasing depot maintenance privatization and outsourcing. *DoD Home Page for Maintenance of Military Equipment* (HTTP://www.acq.osd.mil/log/mp/).

Morrocco, J. D. (1994, April 18). Depot policy proves elusive. *Aviation Week & Space Technology.*

Newby, C. C. (1997, May). *Privatization of depot-level maintenance: Achieving significant savings while maintaining readiness* (DTIC ADA326785). Carlisle Barracks, PA: U.S. Army War College.

Peterson, S. E. (1993, May 8). Funding technology, federal program provides grant so small companies can afford research. *Minneapolis Star Tribune.*

Spaulding, J. A. (1997, May). *Depot maintenance: Barriers to privatization* (DTIC ADA326713). Master's thesis, Air Force Institute of Technology, Wright-Patterson Air Force Base, OH.

Urban, D. Interview. Chief, Depot Engineering Division, U.S. Army Industrial Operations Command.

Valley, J. P. (1997, September). *A comparison of contracts involving the privatization of Newark and the Naval Air Warfare Center—Indianapolis* (DTIC ADA329805). Master's thesis, Air Force Institute of Technology, Wright-Patterson Air Force Base, OH.

Washington, W. N. (1995, June). *Facilitation of university technology transfer through a cooperative service-university-industry program.* Senior Service thesis, University of Texas, Austin, TX. Research and development technical report (1997, May). (CECOM-TR-97-2, DTIC ADA323019). U.S. Army Communications Electronics Command, Fort Monmouth, NJ.

Wax, S. G. (1995, January 25). Interview. Deputy director, Technology Reinvestment Project, Advanced Research Projects Agency.

Widnall clarifies depot decision. (1995, March). *Air Force News Service* (HTTP://www.af.mil/news/Mar1995/n19950316_223.html).

# ACQUISITION REVIEW QUARTERLY GUIDELINES FOR CONTRIBUTORS

The *Acquisition Review Quarterly (ARQ)* is a scholarly peer-reviewed journal published by the Defense Acquisition University. All submissions receive a masked review to ensure impartial evaluation.

## SUBMISSIONS

Submissions are welcomed from anyone involved in the Defense acquisition process. Defense acquisition is defined as the conceptualization, initiation, design, development, test, contracting, production, deployment, logistic support, modification, and disposal of weapons and other systems, supplies, or services to satisfy Defense Department needs, or intended for use in support of military missions.

## RESEARCH ARTICLES

Manuscripts should reflect research or empirically-supported experience in one or more of the aforementioned areas of acquisition. Research or tutorial articles should not exceed 4,500 words. Opinion pieces should be limited to 1,500 words.

We publish Defense Acquisition research articles that involve systemic inquiry into a significant research question. The article must produce a new or revised theory of interest to the acquisition community. You must use a reliable, valid instrument to provide your measured outcomes.

## MANUSCRIPT SECTIONS

The introduction should state the purpose of the article and concisely summarize the rationale for the undertaking.

The methods section should include a detailed methodology that clearly describes work performed. Although it is appropriate to refer to previous publications in this section, the author should provide enough information so that the experienced reader need not read earlier works to gain understanding of the methodology.

The results section should concisely summarize findings of the research and follow the train of thought established in the methods section. This section should not refer to previous publications, but should be devoted solely to the current findings of the author.

The discussion section should emphasize the major findings of the study and its significance. Information presented in the aforementioned sections should not be repeated.

## Research Considerations

Contributors should also consider the following questions in reviewing their research-based articles prior to submission:

- Is the research question significant?
- Are research instruments reliable and valid?
- Are outcomes measured in a way clearly related to the variables under study?
- Does the research design fully and unambiguously test the hypothesis?
- Did you build needed controls into the study?

Contributors of research-based submissions are also reminded they should share any materials and methodology necessary to verify their conclusions.

## Criteria for Tutorials

Tutorials should provide special instruction or knowledge relevant to an area of defense acquisition to inform the Defense Acquisition Workforce.

Topics for submissions should rely on or be derived from observation or experiment, rather than theory. The submission should provide knowledge in a particular area for a particular purpose.

## Opinion Criteria

Opinion articles should reflect judgments based on the special knowledge of the expert. Opinion articles should be based on observable phenomena and presented in a factual manner; that is, submissions should imply detachment. The observation and judgment should not reflect the author's personal feelings or thoughts. Nevertheless, opinion pieces should clearly express a fresh point of view, rather than negatively criticize the view of another previous author.

## Manuscript Style

We will require you to recast your last version of the manuscript, especially citations (e.g., footnotes or endnotes) into the format required in two specific style manuals. The ARQ follows the author (date) form of citation. We expect you to use the Publication Manual of the American Psychological Association (4th Edition), and the Chicago Manual of Style (14th Edition). The ARQ follows the author (date) form of citation.

Contributors are encouraged to seek the advice of a reference librarian in completing citations of government documents. Standard formulas of citations may give only incomplete information in reference to government works. Helpful guidance is also available in Garner, D.L. and Smith, D.H., 1993, The Complete Guide to Citing Government Documents: A Manual for Writers and Librarians (Rev. Ed.), Bethesda, MD: Congressional Information Service, Inc.

## Copyright Information

The *ARQ* is a publication of the United States Government and as such is not copyrighted. Contributors of copyrighted works and copyright holders of works for hire are strongly encouraged to request that a copyright notification be placed on their published work as a safeguard against unintentional infringement. The work of federal employees undertaken as part of their official duties is not subject to copyright.

In citing the work of others, it is the contributor's responsibility to obtain permission from a copyright holder if the proposed use exceeds the fair use provisions of the law (see U.S. Government Printing Office, 1994, Circular 92: Copyright Law of the United States of America, p. 15, Washington, DC: Author). Contributors will be required to submit a copy of the written permission to the editor before publication.

## Manuscript Format

Pages should be double-spaced and organized in the following order: title page, abstract, body, reference list, author's note (if any), and figures or tables. To ensure anonymity, each paper should be submitted with a separate page that includes the author(s)'s name(s) and complete address, and the paper should include the title, abstract, keywords, body, complete set of references, along with tables and figures at the end. Authors are reminded not to refer to themselves or to their own work directly in the paper. Figures or tables should not be inserted (or embedded, etc.) into the text, but segregated one to a page following the text. Articles must be printable within one issue and should not exceed 4,500 words for research or tutorials and 1,500 words for opinion pieces; articles will not be printed in parts or in a continuing series. If material is submitted on a computer diskette, each figure or table should be recorded in a separate, exportable file (i.e., a readable .eps file). For additional information on the preparation of figures or tables, see CBE Scientific Illustration Committee, 1988, Illustrating Science: Standards for Publication, Bethesda, MD: Council of Biology Editors, Inc. Please restructure briefing charts and slides to a look similar to those in previous issues of ARQ.

The author (or corresponding author in the case of multiple authorship) should attach to the manuscript a signed cover letter that provides the author's name, address, and telephone number (fax and Internet addresses are also appreciated). The letter should verify that the submission is an original product of the author; that it has not been published before; and that it is not under consideration by another publication. Details about the manuscript should also be included in this letter: for example, its title, word length, the need for copyright notification, the identification of copyrighted material for which permission must be obtained, a description of the computer application programs and file names used on enclosed diskettes, etc. A short biography of no more than 75 words and a photo of the author will be expected from each author. Author names and e-mail addresses are not part of the 75-word count.

The letter, one copy of the printed manuscript, and any diskettes should be

sturdily packaged and mailed to: Defense Systems Management College, Attn: DSMC Press (*ARQ*), 9820 Belvoir Road, Suite 3, Fort Belvoir, VA 22060-5565.

In most cases, the author will be notified that the submission has been received within 48 hours of its arrival. Following an initial review, submissions will be referred to referees and subsequent consideration by the *ARQ* Editorial Board.

Contributors may direct their questions to the Editor, *ARQ*, at the address shown above, by calling (703) 805-4290 (fax 805- 2917), or via the Internet at:

gonzalezd@dsmc.dsm.mil.

The DSMC Home Page can be accessed at:

http://www.dsmc.dsm.mil.

# LETTERS TO THE EDITOR

We welcome letters to the editor. Please send to: Department of Defense, Defense Systems Management College, ATTN: DSMC Press, 9820 Belvoir Road, Suite 3, Fort Belvoir, VA 22060-5565.

From:
Rear Admiral Rowland G. Freeman III, USN (Ret)
1901 Patriots Colony Drive
Patriots Colony
Williamsburg, VA 22124

Mon, May 17, 1999

In a recent issue of *Acquisition Review Quarterly*,[1] two articles appeared which had a common thesis: It is possible to determine/project with some certitude the success factors for acquisition programs. One study sought to identify factors that contribute to program success.[2] The second article had as its central thought that the use of critical success factors in the development of critical management information systems for the DoD program manager would have significant benefit.[3] In both articles, the selection of the program management databases raises a number of questions.

**What is Missing?**

Of note are the factors not considered significant in the data, such as technical difficulty (this has been the most significant factor in program failure or success and gave rise to Dr. John Foster's *Unknown-Unknowns* when he was Director of Defense Research and Engineering (DDR&E)). No mention is made of the contract, which is the primary interface between government and industry, and has been the cause of much program disruption (C-5, F-111, Army Helicopter, F-14, DD-963). Proper contract administra-

[1] *Acquisition Review Quarterly,* Volume 5, No. 1, Winter 1998.

[2] Maj. Kenneth J. Delano, USAF, Identifying Factors That Contribute to Program Success, 1989.

[3] James H. Dobbins and Richard G. Donnelly, Ph.D., Summary Research Report on Critical Success Factors in Federal Government Program Management, 1998.

tion can make or break a program. More of concern was the statement in the first article "Judged least important were meeting logistics supportability objectives...."

Since logistic support is between 60% and 80% of the cost of a system and without it or even with marginal support, systems fail. Something is amiss in the training and education of our program managers if logistics has no recognized priority. Perhaps an inspection of today's cannibalized aircraft or other systems used to keep others operating might be a good object lesson. No mention in the first study is made of today's most recognized success factor and that is the management information system and the accompanying diagnostic expert system. The second study has it as the number one success factor. Given the advances in risk management, an essential factor in successful programs, it is hard to believe that the first study does not include it, and it ranks number 10 in the second study. Lastly, no mention is made of one of the most difficult barriers to a successful program; transition from development to production.

It is believed that from the data provided by the two articles, all the items listed have a high priority to an individual PM; (a) depending on a his or her experience, (b) where the program was in its cycle when the survey was accomplished, (c) the level of PM training, (d) the level of technical difficulty of the program.

**Where We Have Been**

The first substantive investigation of defense procurement was the Truman Committee in the 40's after WWII. This effort was primarily focused on corruption. With the creation of the Defense Department under James Forrestal, there was a major push to bring order out of chaos; however, procurement problems during the Korean conflict demonstrated that much remained to be done. In the late 50's after extensive testimony from all the services, the Blue Ribbon panel was created, and the results were more regulation and laws plus an effort to professionalize both the contracting field and the program managers. Its results were limited. The McNamara Initiatives in 1961 brought zero based budgeting, cost effectiveness, and other financial legerdemain, again with limited results in improving the probability of program success.

**More Studies**

Then the flood started[4]: The Fitzhugh Commission (1970), The Commission on Government Procurement (1972), the issuance of OMB Circular 109 (1976), Defense Science Board Acquisition Cycle Study (1978), Defense Resource Management Study (1979), Defense Acquisition Improvement Program (1981), Grace Commission (1983), Packard Commission (1986), Goldwater-Nichols Defense Reorganization Act (1986), Defense Management Review (1989) Reinvention Initiatives 1992-?. There was a common thread in the recommendations of these various panels as it pertained to the attributes for successful programs. These are best exemplified by the Packard Commission's "Acquisition Model To Emulate." The features are (1) clear command channels, (2)

[4] GAO/NSIAD-93-15/December 1992, Weapons Acquisition, A Rare Opportunity for Lasting Change.

stability, (3) limited reporting requirements, (4) small high quality staffs, (5) communication with users, and (6) prototyping and testing.

**Add Management Theory**

In the meantime, many new management theories were put forth to try and improve the opportunity for program success; Best Practices, Successful Companies, Total Quality Management, Total Quality Leadership, Drs. Demming and Juran, Cost Schedule and Performance Measurement, Zero Based Budgeting, Zero Defects, Theory X, Theory Y, Theory Z, Milestones, Inch Stones, Critical Path Analysis, Management by Objectives, Fly before Buy, Technology on the Shelf, No Concurrency, Concurrent Engineering, Reinventing the Government, and the list goes on. Useful theory, but each requires careful application and results analysis.

**Results**

Our program success rate has not greatly improved, lead time remains excessive, the drive for new untried technology still remains and delays new systems as unk-unks come to haunt the acquisition. Cost overruns are still with us (see Everglades rehabilitation project), and we ignore history as did the program managers in the first study (logistic support in the Balkans). Both the Committees' of Congress and the General Accounting Office is a tremendous repository of corporate memory. The GAO has issued over 900 reports and testimonies on virtually all aspects of the weapons system acquisition process.[5] These are quality reports even where there are disagreements on recommendations. They should not be ignored. The staffs in the hill Congress reviewed many acquisition successes and failures, sharing knowledge with them can save later problems, and to ignore them is to do so at your peril. It seems we continue to look for a silver bullet or perhaps several, but perhaps history provides better clues.

**How Do We Get There From Here**

The common cry of a troubled program manager normally is to blame the big three to which most management problems are addressed; "If I only had more funds, or if I could only get good people, or if this program was only stable." Programs do not always work that way. In the competitive economic environment in which we operate, there is always competition for funds, and also always short falls. The same holds true of people and program stability.

**FBM Program**

The Fleet Ballistic Missile program was a success not only because it met the Packard Commission model before the model was even articulated, but also because it followed significant management practices: open communication, independent internal evaluation, on-site management representation at contractor plants, strict configuration

[5] GAO/NSIAD93-15/December 1992.

management for approved designs and manufacturing processes, and incentive contracting at the prime level and extensive competition at the subcontract level.[6] It is interesting to note that the average tenure of the Program Manager was years and for 40% of civilian personnel over 10 years.[7] The PMs were men of outstanding technical and management capability.

**Some Lessons and a Proposal**

Program success factors are many and varied and no one set suits all programs. It is evident that the discipline of management, supported by an extensive information system, coupled with an expert IT system to pick out areas that need attention, is a start. Each Program should be supported by modeling and simulation. Starting with the management discipline, it is apparent that the application of the principles of Systems Engineering should be applied to all programs. Unfortunately most PMs have not been trained in Systems Engineering, and the training received at DoD Schools such as the Defense Acquisition University do not emphasize this, but rather group training in many short courses.

An excellent management information system is the second ingredient. The Computer Aided Acquisition and Logistics Program has been in existence for over ten years but how many program managers incorporate it in their programs? An excellent Program Manager Manual HBK 59 exists, we have gone a long way with automated manuals, The Contractor Integrated Technical Information System (CITIS) specification exists, and provides an excellent basis for data exchange with the contractor. A review of the outstanding MIS program for the disposal of hazardous material at Rocky Flats is a good model for the complex programs. There are many excellent simulation and modeling programs available that it is a shame more managers do not take advantage of them, at the minimum use they use as an excellent staff training tool.

A program manager must keep Business Management and Technical Management in balance and a well developed MIS system can aide in this process. The Programs Strategic Plan using the Systems Engineering Process will not guarantee success, but it provides a tried and true technique for program management and a discipline for the program staff. Each program is different, has different goals and objectives, and varying critical areas which can change with the next fax or e-mail. Recognizing what is important is the PM's first priority, and the data system should be defined for his needs, incorporating the factors that he and his contractors are critical, modifying them over time and base lining these against the contract provisions so that he remains within its framework. It is unfortunate that the PM will seldom be around when 20/20 hindsight is used to determine the program's success, but he can console himself with the understanding that if he was promoted for his efforts and the program subsequently failed, he avoided the well known stages of many programs which are; enthusiasm,

[6] GAO/NSIAD-90-160 Defense Acquisition. Fleet Ballistic Program Offers Lessons for Successful Programs.

[7] *Ibid.*

disenchantment, panic, search for the guilty, punishment of the innocent, and decoration of all those who took no part.

**End Notes**

There are many fine volumes on management, and when frustration grows in a program manager, he should read one or more of the following: *Up The Organization* by Robert Townsend, *Parkinson's Law* by C. Northcote Parkinson, *The Peter Principle* by Lawrence Peter, *The Peter Prescription* by Lawrence Peter, *Self Renewal* by John Gardner, *Five Golden Rings* by Miyamoto Musashi, and *Augustine's Laws* by Norman R. Augustine.

There is no cookbook for successful acquisition management. The system delivered to the operating forces must work and be well supported and remember it must be operated by people. In the words of Admiral Jellico at the Battle of Jutland—"The prelude to battle is the work of the engine room"—and so it is with the program manager.

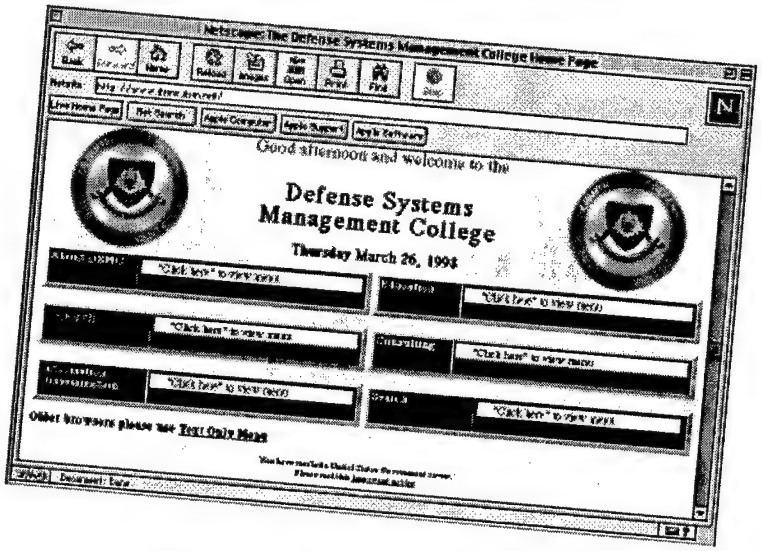
This is a longer than desired critique, but the authors had at least twice the volume, and the body of historical data is very large, but seldom reviewed or really explored. It would be an interesting research effort to really try and define the boundaries of successful project/programs (military and Civilian) over the last three decades.

Very respectfully,
Rear Admiral Rowland G. Freeman III, USN (Ret)

# DSMC'S Home Page

## http://www.dsmc.dsm.mil

### Your Online Access to Acquisition Research, Consulting, Information, and Course Offerings




## On DSMC Home Page Now...

### About DSMC

- Commandant's Welcome
- DSMC Information
- Executive Institute
- DSMC Education
- General Student Information
- Getting to Ft. Belvoir
- News and Events

### Research

- David D. Acker Library
- Acquisition Related Events
- Best Practices
- Lessons Learned
- Overview/Projects
- ROAR
- Information Dissemination
- Related Links
- Publications
- Services

### Education

- Academic Programs Division
- Course Catalog
- Division of College Administration and Services (DCAS)
- Divisions/Faculty Departments
- DSMC Alumni
- DSMC Course List
- The Executive Program Manager's Course (EPMC)
- Access to the EPMC Intranet
- Learning Resource Center
- Program Management
- Regional Centers
- Registrar

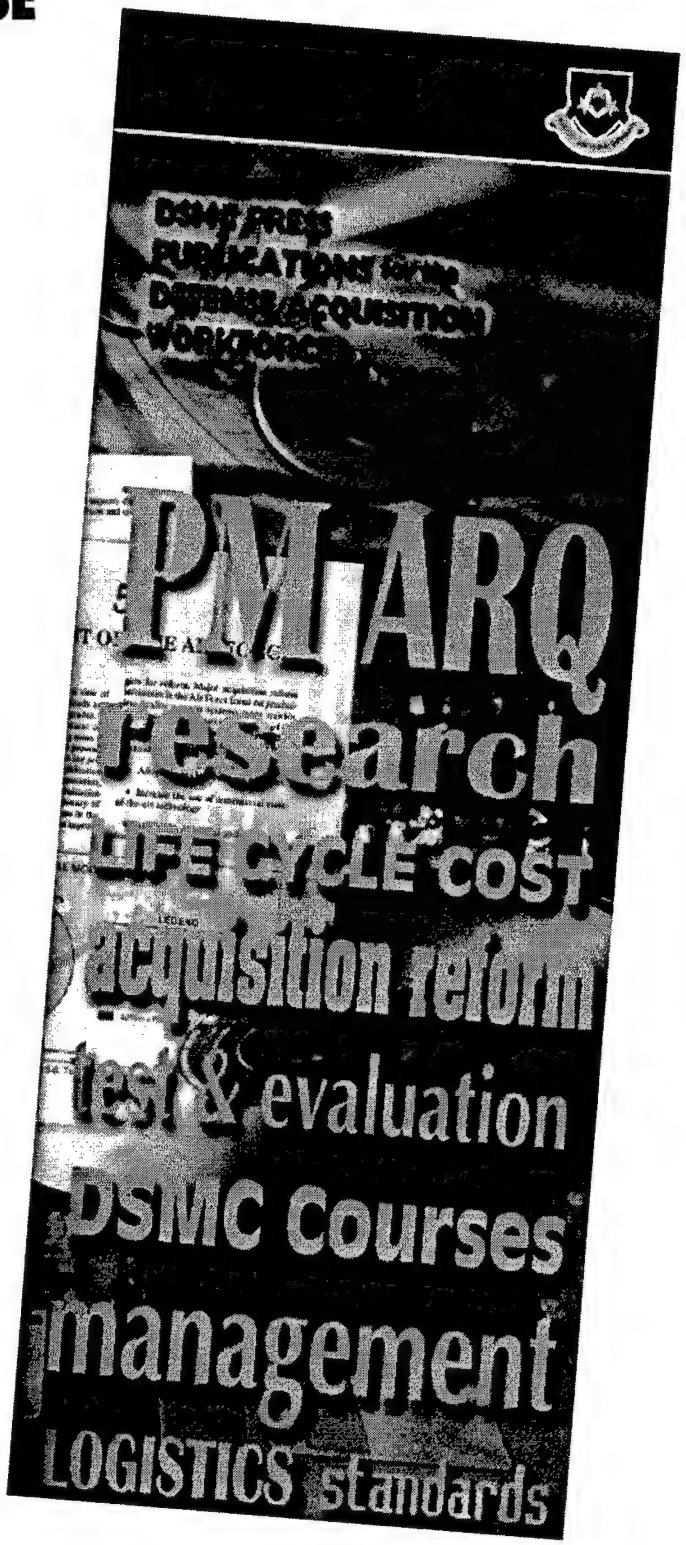
### Consulting

- The Cost Analysis Strategy Assessment (CASA) model
- Expertise List
- Management Deliberation Center (MDC)/Group Services
- Consulting Services

***Now you can Search the DSMC Website and our on-line Publications!***

# DSMC PRESS PUBLICATIONS FOR THE DEFENSE ACQUISITION WORKFORCE

Newly revised and updated, this free brochure is yours by faxing a request to the DSMC Press: (703) 805-2917 or DSN 655-2917. The brochure lists the publications offered by and through the College, including titles, abstracts, prices, sources, and reference numbers.



PROGRAM MANAGER SUBSCRIPTION

Order Processing Code:
*5456

**Superintendent of Documents**
**Subscription Order Form**

*Charge your order. It's easy!*

**To fax your orders (202) 512-2250**

☐ **YES,** please send me ____ subscription(s) to the Program Manager, Journal of the Defense Systems Management College, (PROM) at $14.00 each per year.

The total cost of my order is $_____. Price includes regular shipping and handling and is subject to change. International customers, please add 25%.

Company or personal name (Please type or print)

Additional address/attention line

Street address

City, State, Zip code

Daytime phone including area code

Purchase order number (optional)

For privacy, check box below:
❑ Do not make my name available to other mailers

Check method of payment:
❑ Check payable to Superintendent of Documents
❑ GPO Deposit Account ☐☐☐☐☐☐☐ – ☐☐
❑ VISA ❑ MasterCard ☐☐☐☐ (expiration date)

☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐

***Thank you for your order!***

Authorizing Signature 1/96

**Mail to:** Superintendent of Documents
P.O. Box 371954, Pittsburgh, PA 15250-7954

☐ **Change of address only.**

ARQ SUBSCRIPTION

CHANGE OF ADDRESS

## FREE SUBSCRIPTIONS
## ACQUISITION REVIEW QUARTERLY (ARQ)

☐ **Change of address only.**

☐ Please add my name to your free subscription list.

Name and Title

Organization

Address

City State Zip ( ) Daytime Phone

**FEDERAL EMPLOYEES Can Receive a Free Subscription to**

## PROGRAM MANAGER (PM) and/or ACQUISITION REVIEW QUARTERLY (ARQ)

I am a federal employee (military or civilian) and want to add my name to your free subscription list.

PM ☐
ARQ ☐
BOTH ☐
**Change of address only** ☐

Name and Title

Organization

Address

City State Zip ( ) Daytime Phone

AFFIX
POSTAGE
HERE

SUPERINTENDENT OF DOCUMENTS
P.O. BOX 371954
PITTSBURGH, PA 15250–7954

NO POSTAGE
NECESSARY
IF MAILED
IN THE
UNITED STATES

**BUSINESS REPLY MAIL**
**FIRST CLASS PERMIT NO. 12 FORT BELVOIR, VA**

**POSTAGE WILL BE PAID BY ADDRESSEE**

DEPARTMENT OF DEFENSE
DEFENSE SYST MGMT COLLEGE
ATTN DSMC PRESS
9820 BELVOIR ROAD
SUITE 3
FT BELVOIR VA 22060-9989

NO POSTAGE
NECESSARY
IF MAILED
IN THE
UNITED STATES

**BUSINESS REPLY MAIL**
**FIRST CLASS PERMIT NO. 12 FORT BELVOIR, VA**

**POSTAGE WILL BE PAID BY ADDRESSEE**

DEPARTMENT OF DEFENSE
DEFENSE SYST MGMT COLLEGE
ATTN DSMC PRESS
9820 BELVOIR ROAD
SUITE 3
FT BELVOIR VA 22060-9989

# RENEW *ARQ* NOW!

The U.S. postal regulations require that if you receive a free subscription for *ARQ*, and wish to continue doing so, you must sign, date and return this form no later than **September 17, 1999.** Also, please answer a few questions. Remove the pressure-sensitive label from the publication's cover and place it on the form's designated spot. Make address corrections directly on the label. After signing, dating, and providing information, fold the form so the business reply's mailing address is visible; tape it closed (PLEASE DO NOT STAPLE), and drop it in the mail or fax it to (703) 805-2917. If you do not respond, you will be dropped from our mailing list. This update will keep your subscription current through May 2002.

YES! I (or my office) would like to continue receiving the *Acquisition Review Quarterly.*

_____

(Signature and Date)

**PLEASE PLACE ADDRESS LABEL HERE**

**STATUS (OFFICE OR INDIVIDUAL), CHECK ONE:**

| **DoD Civilian** | **Military** | **Other** |
|---|---|---|
| ❑ OSD | ❑ Army | ❑ Industry |
| ❑ Army | ❑ Navy | ❑ Academia |
| ❑ Navy | ❑ Air Force | ❑ Library (Ind., Acad., Govt.) |
| ❑ Air Force | ❑ Marine Corps | ❑ Complimentary |
| ❑ Marine Corps | ❑ Non-DoD Government | ❑ Other |

**DSMC GRADUATES PLEASE CHECK APPROPRIATE BOX(ES):**
**(Use course # or acronym)**

❑ PMC/APMC Class _____ (ex., APMC 98-1)

❑ Executive Course(s)_____ (ex., EPMC 98-1)

❑ Short Course(s) _____ (ex., ACQ101 98-1)

NO POSTAGE
NECESSARY
IF MAILED
IN THE
UNITED STATES

**BUSINESS REPLY MAIL**
**FIRST CLASS PERMIT NO. 12 FORT BELVOIR, VA**

**POSTAGE WILL BE PAID BY ADDRESSEE**

DEPARTMENT OF DEFENSE
DEFENSE SYST MGMT COLLEGE
ATTN DSMC PRESS/ARQ
9820 BELVOIR ROAD
SUITE 3
FT BELVOIR VA 22060-9989

*ARQ*

Acquisition Review Quarterly